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PRUTHI (H. S.) & SAMUEL (C. K.). **Entomological Investigations on the Leaf-curl Disease of Tobacco in northern India. IV. Transmission of the Disease by White-fly** (*Bemisia gossypiperda*) **from some new alternate Hosts.**—*Indian J. agric. Sci.* **11** pt. 3 pp. 387–409, 2 col. pls., 2 figs., 12 refs. Delhi, 1941.

Details are given of experiments already noticed [*R.A.E.*, A **29** 183; **30** 317] in which various forms of leaf-curl [*Ruga tabaci* of Holmes] were transmitted to tobacco by *Bemisia tabaci*, Gennadius (*gossypiperda*, Misra & Lamba) from a number of other plants, all of which have been found to be naturally infected in Bihar.

RAHMAN (K. A.) & ABDUL WAHID KHAN (M.). **Observations on** *Aphelinus mali* **Hald. in the Punjab.**—*Indian J. agric. Sci.* **11** pt. 3 pp. 446–450, 4 refs. Delhi, 1941.

A short account is given of the introduction and establishment of *Aphelinus mali*, Hald., in the Kulu Valley (Punjab) for the control of *Eriosoma lanigerum*, Hsm., on apple and of its seasonal history there [*cf. R.A.E.*, A **28** 561]. In experiments this Aphelinid did not parasitise any of 13 other species of Aphids offered to it, whereas individual females parasitised up to 220 examples of *E. lanigerum*. Although the parasite is established in the Punjab, it is destroyed, and sometimes eliminated from an orchard, by predators that attack its host and by the winter sprays of diesel oil that are applied to apple for the control of *Aspidiotus* (*Forbesaspis*) *perniciosus*, Comst. The effects of the latter were avoided by keeping apple twigs bearing parasitised and healthy Aphids stuck in the soil in a wire gauze cage (4 ft. by 2 ft. by 2 ft.) from late November or early December, and watering them twice a week throughout the winter. The parasite became active in March and quickly built up an effective population. Protection against predators was achieved by similarly caging twigs bearing parasitised and healthy Aphids in March and April, replacing the twigs by freshly cut infested shoots every 15 days during summer and watering thrice weekly. The parasites bred in the cage and the adults emerged from it regularly, maintaining the field population at an effective level.

HAYWARD (K. J.). **Algunas observaciones sobre las moscas de las frutas en la Argentina.** [Some Observations on Fruit-flies in Argentina.]—*Rev. industr. agríc. Tucumán* **31** no. 7–9 pp. 324–330, 2 graphs. Tucumán, 1941.

Most kinds of fruit in Tucumán, Argentina, are attacked by fruit-flies, and apples and pears were severely infested in 1941. A list is given of the species recorded in the Province, together with a brief account of experiments by the author in Entre Ríos and by E. F. Schultz in Tucumán on the use of bait-traps for their control [see next abstract]. More than 90 per cent. (55,567) of the flies caught in Tucumán were *Anastrepha fraterculus*, Wied., as compared with 1,967 of *Pseudodacus* (*A.*) *daciformis*, Bezzi, 1,795 of *A. lutzi*, Costa Lima, and 70 of other species. Another control measure in Argentina consists in throwing infested fruit into pits and covering it with soil. A cover of perforated zinc in a wooden frame is recommended for such pits to permit the escape of parasites.

HAYWARD (K. J.). **La lucha contra las moscas de las frutas. Breve reseña sobre los cebos ensayados en las diversas partes del mundo y su aplicación con detalles de algunos resultados obtenidos en la Argentina.** [The Control of Fruit-flies. A brief Survey of the Baits tried in various Parts of the World and their Application with Details of some Results obtained in Argentina.]—*Rev. industr. agríc. Tucumán* **31** no. 7–9 pp. 331–349, 40 refs. Tucumán, 1941.

This review of investigations in various parts of the world on baits for fruit-flies is complementary to the bibliography published by the author in 1940

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[*R.A.E.*, A **29** 280]. In experiments by E. F. Schultz in Tucumán, dark beer at a concentration of 50 per cent. in water proved much less attractive to *Anastrepha* than orange or grape-fruit juice and slightly less attractive than pale beer, all at the same concentration, but was more attractive than dark beer or wine vinegar ar a concentration of 25 per cent. Traps of clear glass were rather more effective than those of bluish glass.

In the author's experiments, which were against *Anastrepha fraterculus*, Wied., and *Ceratitis capitata*, Wied., in Entre Ríos, 25 per cent. wine vinegar was more attractive to *A. fraterculus* than other baits, including undiluted orange juice, except in one series in which a pollard bait (12 oz. wheat pollard, 4 oz. molasses, 4 oz. borax, 0·37 oz. disodium hydrogen arsenate and 10 pints water) was the most effective. Orange juice was the most effective against *C. capitata*, followed by the pollard bait. In a final experiment, in which the sex-ratio of the flies was ascertained, baits of pollard, wine vinegar, Clensel (1 : 30), molasses (1 : 12) and dark beer (50 per cent.) caught, respectively, 29·41, 22·85, 17·19, 15·84 and 14·71 per cent. of the total catch of *C. capitata*, of which 75·40, 58·41, 53·95, 64·29 and 58·46 per cent. were females, and 17·32, 29·70, 5·45, 18·82, and 28·71 per cent. of the total catch of *A. fraterculus*, of which 54·29, 43·34, 27·28, 57·90 and 46·56 per cent. were females.

FRANKLIN (H. J.) & CROSS (C. E.). **The Cranberry Station, East Wareham, Massachusetts.**—*Bull. Mass. agric. Exp. Sta.* no. 378 (Rep. 1940) pp. 42–47, 3 refs. Amherst, Mass., 1941.

In 1940, *Tlascala finitella*, Wlk., caused severe damage to more than an acre of cranberries that had been replanted in May. Adults of this Pyralid emerged between 9th and 15th June from pupae that had failed to transform in the previous year [*cf. R.A.E.*, A **30** 75]. Of six treatments tested against *Anthonomus musculus*, Say, sprays containing 6 lb. basic copper arsenate or barium fluosilicate per 100 U.S. gals. water, applied on 6th August at the rate of 400 U.S. gals. per acre, killed 94 and 90 per cent. of the weevils, respectively. *Myzus scammelli*, Mason [*cf.* **29** 45] is found only on bogs that are not reflooded during the growing season, but is sometimes quite abundant and would be an important pest if it were not effectively controlled by larvae and adults of *Coccinella transversoguttata*, Fald., *C. novemnotata*, Hbst., *Hippodamia parenthesis*, Say, and *C. undecimpunctata*, L. Flooding a bog for 27 hours in May with a solution of sodium cyanide at the rate of 6 oz. per 100 U.S. gals. water was less effective against larvae of *Amphicoma vulpina*, Hentz, than the usual application of sodium cyanide with pumping rigs and hose, and more expensive. The cyanide and the flooding treatments used against this Glaphyrid are also effective against the larvae of *Lachnosterna* (*Phyllophaga*) [*anxia*, Lec.], which occur only on bogs that are flooded during the winter and have not been reflooded in spring for several years. Paradichlorobenzene crystals, applied in May at the rate of 600, 800 or 1,200 lb. per acre and covered with nearly an inch of sand, took several weeks to kill larvae of *A. vulpina* and were more expensive than the cyanide treatment; however, practically 100 per cent. mortality was obtained with the highest dosage and 50 per cent. with the next. Paradichlorobenzene applied at 1,200 lb. per acre on 10th August gave very unsatisfactory control.

A spray containing 6 lb. cryolite per 100 U.S. gals. water, applied at 400 U.S. gals. per acre, and a dust of cryolite, applied at 30 lb. per acre, were more effective than lead arsenate against the later larval instars of *Lymantria* (*Porthetria*) *dispar*, L., and the false armyworm [*Xylena nupera*, Lint.], which was much more abundant than it had been for many years, but failed to control maturing larvae of the former. A spray containing 15 lb. derris powder (4 per cent. rotenone) and 2 lb. soap per 100 U.S. gals. water, applied at 400 U.S. gals.

per acre, was as effective as pyrethrum dusts against maturing larvae of *L. dispar* and much cheaper, and one containing 6 lb. basic copper arsenate per 100 U.S. gals., applied at 250 U.S. gals. per acre, was more effective against them than any other stomach poison, but rather less effective than pyrethrum or derris. This spray gave no control of the black-headed fireworm, *Rhopobota* [*naevana*, Hb.]; a spray of 6 lb. cryolite in 100 U.S. gals. water, applied at 300 U.S. gals. per acre, was very effective against the first brood but failed to control the second, and dusting with cryolite was unreliable against either generation. The cryolite spray, applied at 400 U.S. gals. per acre, was ineffective against the blunt-nosed leafhopper, *Ophiola* [*striatula*, Fall.]. *Mineola vaccinii*, Riley, was more destructive than for many years; larvae of *Anomala errans*, F., were found early in May throughout a 17-acre bog; the cranberry spittle insect, *Clastoptera* [*saint-cyri*, Prov.], and the tipworm, *Dasyneura* [*vaccinii*, Smith], were more prevalent than in 1939; and the spotted fireworm, *Tortrix* (*Cacoecia*) [*parallela*, Rob.], was scattered but more abundant than usual. Larvae of *Colaspis brunnea* var. *costipennis*, Crotch [*cf.* **30** 75] pupated about 14th June, the winter water having been removed from the infested area early, and adults emerged between 20th and 26th June.

ALEXANDER (C. P.) & others. **Department of Entomology.**—*Bull. Mass. agric. Exp. Sta.* no. 378 (Rep. 1940) pp. 59–71. Amherst, Mass., 1941.

In investigations in Massachusetts in 1940 with oil emulsion containing dinitro-ortho-cyclohexylphenol, dinitro-ortho-cresol or dinitro-phenol against overwintered eggs of Aphids on dormant apple trees, the first two gave practically complete kill, and the last, though noticeably less effective, gave good commercial control. Solutions of ½, ¾ and 1 per cent. dinitro-o-cyclohexylphenol in oils with viscosities of 52, 87 and 108 secs. Saybolt caused no injury to dormant deciduous ornamental trees or to white spruce [*Picea glauca*], arborvitae [*Thuya*], Irish juniper [*Juniperus communis* var. *hibernica*] and red pine [*Pinus resinosa*]. Applied to lilac at 4 per cent., these oils caused no injury or retardation of development and gave good control of oyster-shell scale [*Lepidosaphes ulmi*, L.]. Commercial dinitro sprays and the oil emulsion containing dinitro-o-cyclohexylphenol gave control of the rosy apple aphis [*Anuraphis roseus*, Baker] directly proportional to the thoroughness of coverage, controlled troublesome infestations of *L. ulmi* and pear psylla [*Psylla pyricola*, Först.] and checked Aphids on various species of *Viburnum*. Inspection of an apple orchard from which sprays had practically eliminated *A. roseus* in 1939 showed serious damage to foliage and fruit in 1940, when no sprays were applied, resulting in complete loss of crop.

The apple maggot [*Rhagoletis pomonella*, Walsh] was somewhat more abundant than in 1939 and appears to be becoming a serious pest. The apple leaf-curling midge, *Dasyneura mali*, Kieff., was generally more abundant, and the area known to be infested by it increased in the west and south-west. Only one of 325 larvae collected in June–August 1939 gave rise to an adult in 1940, but 8–36 per cent. of the larvae collected in September did so, and 42·42, 27·6 and 13·3 per cent. of those collected in June, July and August 1940 gave rise to adults before the winter. Application to the soil of naphthalene flakes at the rate of 1 and 2 lb. per 100 sq. ft. reduced the emergence of the overwintering generation by 83·4 and 80·9 per cent., respectively, and that of the first generation by 75·42 and 93·31 per cent., the numbers of adults emerging from untreated soil averaging 3·56 for the overwintered generation and 22·87 for the first generation per sq. ft. The numbers of flies that emerged from collected dried leaves and hay that had been treated with 2 lb. naphthalene per 100 sq. ft. averaged 0 and 3·69 per lb. in the overwintered and first generations, respectively, the corresponding averages for untreated material being 28·5 and 78·46. Of lead-arsenate sprays applied during the first week of June against

the plum curculio [*Conotrachelus nenuphar*, Hbst.] on apple, the most effective was the one applied on 3rd June, when the maximum temperature and greatest weevil activity occurred.

Larvae hatched from 57·89 per cent. of the eggs of the grape plume moth [*Oxyptilus periscelidactylus*, Fitch] that overwintered on potted grape vines; hatching was completed between 14th and 16th May, and the larval and pupal stages averaged 39·2 and 16·37 days. On heavily infested vines, the number of overwintering eggs averaged 3·18 per node. In laboratory experiments with commercial dormant spray materials, lubricating oil emulsions gave complete mortality of eggs if they contained 3–4 per cent. actual oil and at least 90 per cent. if they contained 1–2 per cent.; lime-sulphur (1 : 8) gave 80 per cent. mortality, and sodium dinitro-cresylate was effective at dilutions of 1–1¼ per cent. but gave only 48 per cent. mortality at ½–¾ per cent. The percentage hatch in controls was 63. In home vineyards, 3 per cent. oil emulsion and ¾ per cent. sodium dinitro-cresylate gave 80·4 and 72·86 per cent. protection, respectively, where 84·12 per cent. of the tips were infested on unsprayed vines, while ½ per cent. sodium dinitro-cresylate and lime-sulphur (1 : 8) gave 92 and 11 per cent. where 58 per cent. of the tips on unsprayed vines were infested. Spraying with lead arsenate and either fish oil or Bordeaux mixture when the buds were breaking was ineffective. Overwintered adults of the grape cane girdler [*Ampeloglypter ater*, Lec.] appeared on the vines when the new canes were about 6 ins. long; mating occurred soon after, and the first girdled canes were observed on 2nd June. The number of oviposition punctures per mated female averaged 3·13 in the insectary, but appeared to be greater in the field. The average duration of development of 27 individuals reared in the insectary was 54·55 days. Though experimental spraying with a mixture of cryolite and fish oil gave moderate protection, weekly applications permitted considerable girdling during the most rapid growth of the vines. In hand-picking, infested canes should be removed well below the lowest girdle, since most of the larvae work towards the base.

The striped cucumber beetle [*Diabrotica melanocephala*, F.] was not numerous on cucumber and melon until July and was less abundant than usual. Most of the insecticides applied eight times between 14th June and 18th July gave at least 90 per cent. control, the most effective being dusts containing rotenone or calcium arsenate. Fibrous talc was the best carrier for the calcium arsenate, but was only slightly superior to pyrophyllite talc. Emergence of the squash vine borer [*Melittia satyriniformis*, Hb.] occurred ten days later than usual, but the infestation in the experimental field averaged 7–45 larvae per squash vine and was the heaviest for five years. When applied on 10th, 18th, 24th and 31st July, dusts of rotenone and talc and sprays of nicotine sulphate (1 : 250) or nicotine sulphate (1 : 500) with 1 per cent. oil emulsion all reduced the number of larvae by at least 79 per cent.

Infestation by the cabbage maggot [*Hylemyia brassicae*, Bch.] was moderately heavy, but, owing to favourable growing conditions, satisfactory yields were obtained. Treatment with a solution of 1 oz. corrosive sublimate [mercuric chloride] or a suspension of 4 oz. calomel [mercurous chloride] and 3¾ oz. gum arabic in 10 U.S. gals. water gave commercial control, and, because of the cold weather, was slightly more effective when applied on 18th May than on 11th, when the first eggs were found. A dust of 4 per cent. calomel in talc gave 80 per cent. large and medium heads. Root treatments at transplanting were less effective than in the previous year [*cf. R.A.E.*, A **30** 78]; pure calomel gave commercial control of the larvae but resulted in 36 per cent. small heads owing to plant injury: pyrophyllite talc was more effective than fibrous talc as a carrier for 25 and 50 per cent. calomel. The appearance of the onion thrips [*Thrips tabaci*, Lind.] was delayed by abnormally cold weather, but it increased rapidly during late July and early August. Insecticide tests largely confirmed the results obtained in the previous year [*cf. loc. cit.*]; naphthalene flakes,

applied to the soil along the rows, gave unreliable results. Flea-beetles [*Epitrix cucumeris*, Harr.] were comparatively rare on potatoes until late July, when a heavy infestation caused considerable damage to unsprayed foliage. There was practically no difference in the protection given by standard Bordeaux mixture (5 : 5 : 50) and Bordeaux mixture containing half the quantity of lime, but in both the addition of calcium arsenate materially reduced the amount of damage to the plants.

Owing to the cold weather, infestation of maize by the European corn borer [*Pyrausta nubilalis*, Hb.] was light, but sprays and dusts of derris or dual-fixed nicotine proved of considerable value against the first generation.

No recoveries of *Bigonicheta setipennis*, Fall., were made between July and October in traps placed in localities in which this parasite had been liberated against earwigs [*Forficula auricularia*, L.] in 1939 [*cf.* **30** 79], but the earwig population throughout the infested area was lower than in 1939.

In experimental fumigation with a mixture of chlornaphthalene oil and crystal naphthalene (3 : 1) at the rate of ½ oz. per 1,000 cu. ft. for 6 hours at temperatures and humidities kept constant throughout the period of exposure, the percentage mortalities of *Tetranychus telarius*, L., on greenhouse carnations were 100 at 80°F. and 80 or 90 per cent. relative humidity, 80–90 at 60 and 70°F. and 80 and 90 per cent. relative humidity and 50–83 at 50 per cent. relative humidity. Two successive fumigations gave complete mortality at 80°F. and 50 per cent. relative humidity, at 70 or 80°F. and 60 per cent. relative humidity, and at 60, 70 or 80°F. at 70 per cent. relative humidity or higher. In tests with eight commercial rotenone preparations against *T. telarius* on roses under normal greenhouse conditions, the addition of a neutral copper fungicide decreased the efficiency of insecticides consisting principally of rotenone and an emulsifier by about 5 per cent., but had no effect on those containing other insecticidal ingredients, such as a thiocyanate or light mineral oil. Only these last gave satisfactory control after four weekly applications, and only the sprays that caused a mortality of at least 50 per cent. prevented an increase in population. On potted rose plants, a mixture of tartar emetic and a wetting agent gave promising results when brown sugar was added, but was ineffective without it ; there was some indication of plant injury from this material.

Pepper (J. H.) & Hastings (E.). **Life History and Control of the Sugar-beet Webworm** *Loxostege sticticalis* **(L.).**—*Bull. Mont. agric. Exp. Sta.* no. 389, 32 pp., 10 figs., 77 refs. Bozeman, Mont., 1941.

Pepper (J. H.) & Hastings (E. B.). **The Sugar-beet Webworm in Montana.**—*Circ. Mont. agric. Exp. Sta.* no. 162, 8 pp., 5 figs. Bozeman, Mont., 1941.

The first of these papers contains data obtained in Montana during six years on the biology and control of *Loxostege sticticalis*, L., the larvae of which frequently cause serious damage there to sugar beet, market-garden crops and home gardens, and includes references to the observations of numerous other workers. The adults sometimes occur in great numbers on both waste and cultivated ground, are strongly attracted to lights, particularly blue neon lights, and have a tendency to migrate in large numbers under certain climatic conditions [*cf. R.A.E.*, A **24** 816]. There is often a marked segregation of the sexes, as many as 98 per cent. of the moths within an area being of the same sex. Since sterility of the females is common, a heavy flight of moths may not presage an outbreak of larvae ; the percentage of sterility may be determined from the more worn appearance and reduced activity of the fertile females and by examination of the abdominal contents under low magnification. Many reasons have been advanced to account for sterility [*cf.* **21** 160 ; **25** 309, etc.], but extensive studies in Montana showed no correlation between this condition

and temperature, rainfall, the presence of flowering plants as a source of adult food or a combination of these factors ; it was found that all females may be fertile in small areas surrounded by territories with the same weather conditions in which 90 per cent. are sterile, and that in years of high sterility, at least 1–2 per cent. of the females contain well-developed eggs. These are deposited singly or in rows on the leaves, usually on the underside and preferably on small succulent plants, and hatch in about 7–10 days. In captivity, females laid an average of 120–150 eggs, with a maximum of 250, and dissected females were found to contain over 300 eggs in various stages of development.

The larvae readily migrate to adjacent fields if food becomes scarce, and during outbreak years, large, definitely oriented migrations of older larvae, apparently not due to lack of food, may occur. No correlation has been found between these mass migrations and light, temperature or air currents. Larvae collected in the field during the first instar and kept at constant temperatures of 90, 79 and 72°F. pupated after averages of 12, 18 and 29 days ; those kept at 60° did not pupate until removed to a higher temperature, when they did so immediately. Tests during 1937–38 in which larvae were fed on single species of plants showed that both the length of the larval stage and the size of the larvae were affected by the food-plant, those reared on Russian thistle (*Salsola kali*) being the largest and the first to pupate. When full-fed, the larvae burrow into the ground and construct cocoons just below the surface. Some pupate within a few days, the average pupal periods for 75 individuals kept at constant temperatures of 64, 72, 81 and 90°F. being 35, 16, 9 and 6 days, respectively, but a certain proportion overwinter within the cells. The percentage of the first generation that enter diapause in Montana varies from 0·5 to over 60. Laboratory studies in 1938–39 showed no correlation between the proportion entering diapause and either temperature or food-plants during the larval period, and rearing under laboratory conditions caused little deviation from the proportion of diapausing larvae found in nature [*cf.* **25** 58, etc.]. When larvae were collected in the first instar and kept in the laboratory, parasitic larvae within them became mature at the same time as their hosts, but when the latter diapaused, the parasites were very small and undeveloped. It is concluded therefore that the factors determining the diapause had operated before and not after the larvae were collected. Overwintered larvae pupate and the adults emerge in spring. In long periods of warm weather, practically all emerge in a short time, and heavy flights of moths occur, but in variable weather, emergence is gradual and has been observed to extend from the first week in May to the first week in July. Under favourable conditions, oviposition begins about a week after emergence, chiefly on young weeds, but if the weather is cold and windy, it may be delayed for a month, and the eggs may then be laid also on sugar-beet and vegetables. The larvae usually mature and enter the soil by the end of June or the first week in July ; adults emerge 2–3 weeks later and oviposit. The development of the second generation is more rapid than that of the first, owing to higher temperatures, and practically all the larvae diapause. Very rarely there is a partial third generation in Montana [*cf.* **25** 556].

Larval feeding may result in the death of small plants and always causes serious retardation in growth ; the larvae occasionally cause severe damage to lucerne, clover and wheat, and when migrating may completely destroy garden plants and be a nuisance in houses. The feeding of the adults on nectar has sometimes made the supplementary feeding of bees necessary in Montana. Lists, compiled from the literature and from observations, are given of 86 species of plants, belonging to 33 families, on which the larvae are known to feed, of 12 Dipterous and 59 Hymenopterous parasites and of 12 insect predators, showing in each case which occur in Montana ; a number of birds have also been recorded as feeding on the webworm, and both fungous and bacterial diseases have been observed to attack it. Of the parasites reared by the authors, *Bracon vulgaris*, Cress., was by far the commonest.

Successful control depends on the detection of the larvae in their early stages, and as much information as possible about future outbreaks should be obtained by determining the proportion of sterile moths in the overwintered generation and the proportion of the first generation that enter diapause or are sterile, and also by examining food-plants for eggs after a moth flight. In laboratory tests, there was no significant difference in effectiveness between dusts containing 0·75 per cent. rotenone and 1·5 per cent. other resins from cubé root or 2·4 per cent. nicotine as alkaloid and a spray of 1·5 lb. per 100 U.S. gals. of a stock containing 1·2 per cent. pyrethrins, 10 per cent. petroleum oil and 88·8 per cent. inert ingredients, but mortality occurred rather earlier when the insecticides were applied to the larvae than when they were applied to the foliage only and when the temperature was 86 than when it was 68°F. The results against the fourth and fifth instars were unsatisfactory. In field tests in the summer of 1939, the pyrethrum spray and one containing 4 lb. Paris green and 4 lb. slaked lime in 50 U.S. gals. water, with a spreader, gave 97·5 and 95 per cent. control of the first three instars when the plants were thoroughly covered, and 48 and 58 per cent. when only the upper surfaces of the leaves were sprayed. In 1940, the Paris green spray gave similar control of fourth- and fifth-instar larvae, though the time required was considerably longer, but the pyrethrum spray was ineffective. A spray boom that gives complete coverage of the plants is described. Infested weeds should be sprayed or destroyed, and gardens or beet fields can be protected by running water in ditches between the advancing larvae and the crops. Other control methods, such as the use of light-traps and cultivation to destroy overwintering larvae, are unimportant in Montana.

The second paper is based on the first and comprises a short and popular account of the life-history and control of *L. sticticalis* in Montana.

Korstian (C. F.) & Ruggles (A. G.). **Report of Findings and Recommendations with Reference to the Gypsy Moth Project of the Bureau of Entomology and Plant Quarantine.**—*J. For.* **39** no. 12 pp. 973–977. Washington, D.C., 1941.

This report of a special committee appointed in April 1940 to examine the work carried out to combat the gipsy moth [*Lymantria dispar*, L.] by the U. S. Bureau of Entomology and Plant Quarantine and co-operating States [*cf. R.A.E.*, A **29** 212] comprises a survey of the present position in the barrier zone and to the east and west of it, with recommendations for future work. Spraying is the best method of direct control, but should be limited mainly to trees in roads and parks and to heavy infestations that threaten the barrier zone. The mixture of lead arsenate and fish oil used at present appears to be satisfactory except on leafless trees, but more spray equipment, including autogiros, is required. In forest stands, indirect control by silvicultural methods, whereby trees that are favoured food-plants are removed and the stands are gradually transformed into mixtures permanently resistant to infestation, should be increased wherever practicable. From the infested region east of the zone it is reported that these two methods give more permanent and economic control than treating the egg-masses with creosote. As no climatic or other natural barrier to the spread of the moth is known to exist, it is important that the present barrier zone should be maintained, and silvicultural work directed to transforming it into a permanent barrier should be carried out in addition to that of preventing the development of infestations. Control is less important in the northern section of the zone, where climatic factors and the relative scarcity of favoured food-plants check the insect and conditions to the west are unsuitable for it, than in the south, where the climate is milder, the proportion of favoured food-plants higher and conditions beyond the zone apparently suitable for the spread and development of the infestation. It is, therefore,

suggested that repeated surveys of unfavourable districts should be abandoned, and silvicultural work in favourable ones, as well as intensive treatment of heavy infestations and surveys of areas of potential infestation, in the zone and beyond it, increased. The quarantine measures in practice, though satisfactory, should be more stringently applied to motor traffic, and further research should be made on the ecology of the moth and on the development of contact insecticides and of artificial attractants to use in survey traps. Finally, the authors recommend that the funds allocated to research and control should be considerably increased and that greater publicity should be given to the importance of the problem.

Spurr (S. H.) & Friend (R. B.). **Compression Wood in weeviled Northern White Pine.**—*J. For.* **39** no. 12 pp. 1005–1006, 1 fig., 7 refs. Washington, D.C., 1941.

The authors point out that the stem of a white pine (*Pinus strobus*) that has attempted to straighten itself after the leader has been destroyed by *Pissodes strobi*, Peck, is unsatisfactory as a saw log, owing not only to the presence of cross-grain and large knots, but also to the occurrence of compression wood, which is brittle and causes boards to warp excessively.

Baker (W. L.). **Effect of Gypsy Moth Defoliation on certain Forest Trees.**—*J. For.* **39** no. 12 pp. 1017–1022, 4 figs., 4 refs. Washington, D.C., 1941.

The following is based on the author's summary. Economic injury by the gipsy moth, *Lymantria* (*Porthetria*) *dispar*, L., to forest trees in the north-eastern United States has been most severe on oaks and white pine [*Pinus strobus*]. Records of the degree of defoliation, death of trees and loss of diameter increment were collected from trees in a wide series of plots from 1912 to 1921. During this period, the percentages of defoliation and mortality averaged 37 and 30 for highly favoured trees, and 10 and 13 for those not favoured as food. An increase in average degree of defoliation was associated in general with an increase in mortality. The greatest mortality occurred between 1912 and 1915, among trees weakened by heavy defoliation, drought and infestation by *Agrilus bilineatus*, Weber, which attacked oaks in eastern districts. In a series of plots discarded prior to 1915, owing to excessive change in plot conditions, 62 per cent. of the trees died, the average defoliation for the four-year period being 56 per cent. In the plots retained, defoliation and death during the same period averaged only 38 and 28 per cent. In young white pines defoliated only once, there was a direct correlation between percentage defoliation and the percentage of trees dying during the following nine-year period.

Data on the relation of defoliation to diameter increment of four species of oaks and of white pine for the period showed a direct correlation between percentage defoliation and the decline in radial growth. The increment among oaks that were 81–100 per cent. defoliated was only about half that of those 0–20 per cent. defoliated. The same was approximately true of white pine. From an analysis of defoliation and growth data for three species of oak, it was found that diameter growth fluctuated inversely with percentage defoliation in the year in which the defoliation occurred. Continuous fairly heavy defoliation of one species of oak for a period of six years apparently so reduced the vitality of the trees that they failed to recuperate in the following three years, regardless of the degree of defoliation.

Balch (R. E.). **The Spruce Sawfly Outbreak in 1941.**—*Pulp. Pap. Mag. Canada* [1942] repr. 4 pp., 1 map, 3 refs. Montreal [1942].

In general, the reduction in the outbreak of *G. hercyniae*, Htg. (*polytoma*, auct.) on spruce in eastern Canada that was noted in 1940 [*cf. R.A.E.*, A **29** 531] continued in 1941. In the Maritime Provinces and the Gaspé Peninsula, cool and rather dry weather during spring and early summer reduced and delayed

emergence of the sawfly, and also reduced the activity and the number of generations of the parasite, *Microplectron* [*fuscipenne*, Zett.]. In the Gaspé, the emergence of *G. hercyniae* was estimated at 14 per cent. or less.

Disease continued to cause considerable larval mortality throughout most of the infested area [*cf. loc. cit.*] and was important for the first time in central Gaspé, where it appeared in mid-summer before many larvae had become full-grown. Although it can probably control the larvae over a wide range of climatic conditions, it appears to be more effective in warm districts ; in some parts of central New Brunswick, it destroyed almost all the larvae except those that were fully grown before the end of July. Although laboratory investigations suggest that the causal agent is a virus, F. T. Bird has found a bacterium that appears to be associated with the disease. All feeding stages are attacked, and infected larvae do not as a rule spin cocoons.

Further field studies on parasites by W. A. Reeks supported previous conclusions [*cf. loc. cit.*]. The reduction in the number of host cocoons again checked the increase of *Microplectron* and *Exenterus* spp., but recoveries at scattered points in New Brunswick showed that they did not die out, even where the sawfly had become very scarce. All the larvae parasitised by *Exenterus* in one district were diseased, but in another, in which the highest successful parasitism of sound cocoons was only 9 per cent., the parasite was widely distributed. Some oviposition by *Microplectron* occurred at 46°F., though temperatures of over 50°F. are generally required ; the rate of development increased with increased temperatures. In a district in New Brunswick where the maximum ground temperatures ranged from 52 to 62°F. during most of the summer, there were only two generations during the year [*cf.* **29** 38]. Up to 45 per cent. of sawfly cocoons are opened by mice and shrews, but R. F. Morris has found that mice open cocoons containing dead and parasitised larvae in addition to living ones ; the rate of parasitism should therefore be expressed in terms of living sawflies and parasites only, and this is best ascertained during the dormant season.

The distribution and degree of infestation by *G. hercyniae* in Canada and the United States in 1941 are shown on a map. It was collected for the first time from Newfoundland, but other new records indicated only a more general distribution within the main infested area. In general, populations were reduced throughout the infested area, including the interior of the Gaspé Peninsula, but there was an increase in population in some places. Except in the heavily-infested areas of central Gaspé, no trees died and defoliated stands were recovering ; in Gaspé, the total mortality by volume of black spruce [*Picea mariana*] (44·6 per cent.) and white spruce [*P. glauca*] (75·3 per cent.) represented only slight increases over that in 1940 [*cf.* **29** 532], but many of the living trees were in a condition from which they would not recover. Studies by L. J. Simpson showed that in many trees there has been no increase or only very little in the girth of the lower trunk for as long as seven years. Since most of the damaged trees are in valley bottoms and on gentle slopes, where the most accessible and highest-yielding stands are situated, the cost of felling and transport in these districts may be increased to a point at which it becomes impracticable. There was again practically no attack by *Dendroctonus piceaperda*, Hopk. Although the risk of extensive damage to spruce outside the Gaspé area has been largely removed, *G. hercyniae* continues to be of potential importance as a forest pest.

Balch (R. E.). **Report of Forest Insect Conditions in Nova Scotia in 1941.**— *Rep. Dep. Lds For. N.S. 1941* pp. 35–38, 4 maps. Halifax, N.S., 1942.

Gilpinia hercyniae, Htg., was present in small numbers on spruce throughout Nova Scotia in 1941, but it is considered that any serious increase of this sawfly in the immediate future is likely to be prevented by the combined action of disease and introduced parasites. A further 5,000,000

individuals of *Microplectron fuscipenne*, Zett., were liberated during the year. *Chermes* (*Adelges*) *piceae*, Ratz., killed or injured single trees and small groups of balsam fir [*Abies balsamea*] at scattered points throughout the Province. This Aphid occurs in most stands of *A. balsamea* and is likely to cause periodic though insignificant damage. The European predator, *Leucopis obscura*, Hal., which has given good control of *C. piceae* in New Brunswick [*cf. R.A.E.*, A **22** 314], was liberated in one county in Nova Scotia and became established. *Peronea variana*, Fern., was common on *A. balsamea*, though nowhere abundant. Mature stands throughout much of an area on Cape Breton Island that was attacked by it ten years previously have since died; mortality was most complete in mixed stands and on high ground. The risk of severe periodic loss from insects could be reduced by designing future cutting to produce a more normal distribution of the age classes and by felling mature stands in infested areas before mortality and deterioration makes salvage operations unprofitable.

Agrilus anxius, Gory, which has been causing widespread mortality among all species of birch in New Brunswick [**29** 347] and elsewhere in Canada, is becoming active in two counties of Nova Scotia, in one of which 40 per cent. of the trees felled for lumber were infested and showing signs of die-back. The most important factors favouring the increase of this Buprestid are the presence of over-mature birch stands, since mature trees are the most susceptible, and weakened trees. The resistance of the trees has been lowered in recent years by attack by the birch leaf skeletoniser [*Bucculatrix canadensisella*, Chamb.], the birch lace-bug [*Corythucha pallipes*, Parsh.] and two leaf-mining sawflies. *Cryptococcus fagi*, Baer., was still numerous on beech in many localities after an outbreak that destroyed most of the mature stands in the Province; young stands were recovering from the attack. During the past two or three years, *Dendroctonus piceaperda*, Hopk., has destroyed mature spruce in two counties; this Scolytid generally attacks only large white and red spruce [*Picea glauca* and *P. rubra*]. *Pristiphora erichsoni*, Htg., caused some defoliation of larch; the introduced parasite, *Mesoleius tenthredinis*, Morl., was recovered from a number of collections and is affording some control. *Coleophora laricella*, Hb., caused considerable browning of larch foliage in the early summer.

Other species of potential importance that were present on spruce foliage in small numbers were *Ellopia fiscellaria*, Gn., *Nepytia canosaria*, Wlk., *Caripeta divisata*, Wlk., *Protoboarmia porcelaria*, Gn., *Semiothisa granitata*, Gn., *Pikonema dimmocki*, Cress., *P. alaskensis*, Rohw., *Feralia jocosa*, Gn., and *Orgyia* (*Nototolophus*) *antiqua*, L.

The distribution of *Gilpinia hercyniae*, *Chermes piceae*, *Agrilus anxius* and *Cryptococcus fagi* in Nova Scotia, New Brunswick and Prince Edward Island in 1941 is shown on maps.

Imms (A. D.). **Outlines of Entomology.**—Demy 8vo, vii+184 pp., 96 figs. London, Methuen & Co., Ltd., 1942. Price 12*s.* 6*d.*

The following is taken from the author's preface: This book is intended for anyone who is willing to take sufficient pains to acquire an elementary knowledge of entomology as a branch of general zoology. It is consequently written more especially for the student who embarks upon a university training in zoology or agriculture in preparation for a career. It will further serve as a preliminary manual for the would-be professional entomologist during his first year's course.

Raucourt (M.) & Guérin (H.). **Sur les propriétés antidoryphoriques des arséniates alcalinoterreux.**—*C. R. Acad. Sci.* **213** no. 21 pp. 745–748, 1 graph, 6 refs. Paris, 1941.

In view of the lack of precise information on the relative toxicity to *Leptinotarsa decemlineata*, Say, of different calcium arsenates and of calcium and lead

arsenates, experiments were carried out with a number of chemically pure salts, including calcium arsenates prepared by direct action between solutions of arsenic acid and aqueous suspensions of calcium hydroxide, and lead (diplumbic) arsenate. The median lethal dosages, expressed in micrograms per gm. body weight and determined for individual larvae confined on potato leaves covered with the arsenicals, were 32 for calcium metarsenate, 8 for tetrahydric dicalcium orthoarsenate, 6 for calcium pyroarsenate, 9 for pentacalcium diarsenate ($2As_2O_5.5OCa.5OH_2$), 15 for tetracalcium arsenate ($As_2O_5.4OCa.OH_2$), 10 for anhydrous tricalcium orthoarsenate, prepared by dehydrating the decahydrate at 300°C., and 19 for lead arsenate ; for anhydrous tristrontium orthoarsenate and anhydrous tribarium orthoarsenate, prepared in a similar manner to the tricalcium salt, the median lethal dosages were 9 and 10, respectively.

These results were confirmed in further tests, in which the insecticides were applied in sprays to growing potatoes at the rate of approximately 1 lb. arsenic per acre, and the mortality of larvae of *L. decemlineata* was determined on the four days following application and plotted on a graph. It was found that, with the exception of calcium metarsenate, which is insoluble in water and acids, the calcium, barium and strontium arsenates gave similar results and were more effective than lead arsenate, in spite of the fact that no adhesives were used and that, in some cases, the particles were relatively coarse. There was no damage to the plants. It is concluded, therefore, that the substitution of calcium arsenates for the lead arsenates commonly used in France would improve the control of *L. decemlineata* on potato, while reducing the risk from arsenical residues and avoiding that from lead residues.

[Smol'yannikov (V. V.).] **Смольянников (В. В.). The Breeding of Egg Parasites for the Control of Cereal Bugs.** [*In Russian.*]—2nd edn., 16 pp., 9 figs. Krasnodar, Kraev. Knigoizd., 1940. [Recd. 1942.]

Work on the control of Pentatomid bugs [species of *Eurygaster* and related genera] on cereals by means of their Scelionid egg-parasites [*R.A.E.*, A **30** 240, 300] has of recent years been carried out on an increasingly large scale in Russia. These parasites are scarce in nature in spring, when the overwintered bugs are ovipositing, but they can be bred indoors throughout the winter and released in large numbers in the field in April, 3–4 days after the bugs appear. This booklet contains directions as to the technique to be employed, and is intended for farm workers. It is recommended that each farming community should breed the parasites for its own use. Notes on the bionomics of the bugs are included. For breeding purposes the bugs should be collected from their hibernation quarters in autumn and kept in flat boxes containing layers of dead leaves at a temperature between −3 and 7°C. [26·6–44·6°F.], at which they remain inactive. For feeding and oviposition they are transferred to cages in a light room and kept at 26–32°C. [78·8–89·6°F.] and a relative humidity of 70 per cent. These cages contain growing plants, preferably of soft summer wheat 4–6 ins. tall, for the bugs to feed on, and also a few old dry wheat plants bearing ears, and paper crumpled on the bottom of the cage or hung in strips from the top, on which they lay their eggs. When the eggs have been laid, the leaves or paper bearing them are pasted on to strips of cardboard and placed in boxes with holes to permit the introduction and feeding of the parasites. The latter are introduced at the rate of 10 per 200–300 eggs ; every 2–3 days the eggs are replaced by new ones and half the initial number of parasites added. If eggs are not available for parasitism, the newly emerged parasites are kept in jars at 2–6°C. [35·6–42·8°F.], at which they are inactive. Parasites kept at higher temperatures must be fed on a fresh solution of 1 part honey in 1–2 parts water. Unparasitised eggs, and those containing parasites about to emerge, can also be kept at 2–6°C. for about a month. The parasites can be reared at various

temperatures ; those reared at lower temperatures take longer to develop but are more resistant to cold weather. Adults of the same generation reared at different temperatures should be kept together for pairing.

Before being released, the newly emerged parasites are kept and fed for 1–3 days in insectaries or glass jars, during which time they pair. They are then transferred to wide-necked bottles and taken to the fields, where they are released more or less evenly at the rate of 4,000 per acre for a bug population of about 4 per sq. yd.

[Arkhangel'skiĭ (N. N.).] **Архангельский (Н. Н.). The Injurious Tortoise Bug** [*Eurygaster integriceps*, Put.] **and its Control.** [*In Russian.*]—79 pp., 16 figs., 25 diagrs. Rostov-on-Don, Rostov. obl. Knigoizd., 1941. Price 1 *rub.*

[Shchepetil'nikova (V. A.).] **Щепетильникова (В. А.). The Control of the Tortoise Bug** [*Eurygaster integriceps*, Put.]. [*In Russian.*]—44 pp., 10 figs., 1 diagr. Moscow, Sel'khozgiz, 1941. Price 1 *rub.*

The first of these booklets is based on the author's investigations [*cf. R.A.E.*, A **29** 574] and the experience of workers on farms in the Province of Rostov and in the Ukraine. It contains brief notes on the morphology and biology of *Eurygaster integriceps*, Put., on cereals and directions for estimating the abundance of the bugs in the forest litter in autumn and in fields in spring. The control measures recommended comprise the use of fowls [*cf.* **30** 334, 374] ; the collection and breeding of Scelionid egg-parasites [*cf.* preceding abstract] ; the collection of the bugs in the field by hand or by various mobile traps, some of which also collect the eggs and which are described and figured in an appendix ; raking the forest litter into heaps and covering it with soil to destroy the hibernating bugs ; and such supplementary measures as early harvesting, deep ploughing of stubble, the use of bait-sprays containing 2 per cent. molasses and 5 per cent. barium chloride or sodium fluoride, or 0·1 per cent. sodium arsenite, the last with the addition of 3 per cent. lime, and the destruction of the bugs in stubble fields by means of poisoned baits consisting of seeds of maize, wheat or rye, soaked in water and then in a 1 per cent. solution of sodium arsenite, and set out in small heaps covered with bunches of reeds. It is emphasised that effective control can be obtained only by a combination of all available measures.

In the second booklet is given an account of the successful use of a combination of the control measures recommended in the first one on a farm heavily infested by *E. integriceps* in the Province of Stalin in 1940.

Mathur (R. N.) & Gupta (B. D.). **An Analysis of Factors underlying the Deterioration of Sugarcane Crop in the Districts of Meerut and Muzaffarnagar during the Season 1937–38.**—*Proc. 9th Conv. Sug. Tech. Ass. India* pp. 1–10, 1 fldg. map. Nawabganj, U.P., 1940. [Recd. 1942.]

The results are given of a study of the factors that may have been responsible for a great deterioration of the sugar-cane crop that occurred in the districts of Meerut and Muzaffarnagar, United Provinces, during 1937–38. It is concluded that infestation by *Pyrilla* was the chief one, although the development of this Lophopid was dependent on the local climatic conditions during summer and the monsoon months (July–September). Increasing lengths and intensity of drought during the monsoon were followed by corresponding increases in infestation and a higher proportion of damage to cane. Secondary causes, such as heavy and unbalanced nitrogenous manuring, aggravate an outbreak of *Pyrilla* and favour its development, but cannot in themselves cause a major outbreak in a year climatically unfavourable to it.

MATHUR (R. N.). **Certain physiological Considerations in the Damage caused to Sugarcane by** *Pyrilla*.—*Proc. 10th Conv. Sug. Tech. Ass. India* pp. 35–44, 4 refs. Nawabganj, U.P., 1941.

Observations at Shahjahanpur, United Provinces, during 1937–38 and subsequent years indicated that the extent of damage to sugar-cane by *Pyrilla* is influenced by the nitrogen nutrition of the plant [*cf.* preceding abstract] and by the time of planting. In normal years, the yields of cane and sugar increased and the sucrose content decreased with additional nitrogen, for all planting dates, but during the severe outbreak of *Pyrilla* in 1937–38 the additional nitrogen produced much poorer results ; the yield of cane was lowered, the sucrose content of the juice decreased markedly and the available sugar also declined. Attack by *Pyrilla* was more severe and oviposition much heavier on crops that were given additional nitrogen than on those that were not, and it appears, therefore, that excess of nitrogenous fertilisers is not advantageous during years climatically suited to the development of *Pyrilla*. In normal years, high yields of cane and sugar were obtained by planting early in the season, but low yields of cane and sugar were obtained during the outbreak in 1937–38, while a greater depreciation in sucrose content of juice was observed in early-sown cane. When seed material was derived from crops severely damaged by *Pyrilla*, germination was very poor in early plantings, but improved with later ones.

MATHUR (R. N.). **Certain Observations on the Nitrogen Nutrition of the Sugarcane Plant in Relation to Susceptibility to Attack of White-fly.**—*Proc. 10th Conv. Sug. Tech. Ass. India* pp. 45–53, 1 fig., 5 refs. Nawabganj, U.P., 1941.

An account is given of field and laboratory observations in the United Provinces in 1937–40, which indicated that infestation of sugar-cane by *Aleurolobus barodensis*, Mask., is generally severe when the plants are physiologically starved of nitrogen. Conversely, it is negligible when the nitrogen supply is adequate. It is further considered that nitrogen starvation is the cause of the increased infestation that has been associated with water-logged crops. Plant cane and ratoons are similarly affected. It is emphasised that nitrogen starvation is not in itself sufficient to cause a major outbreak, but it accentuates an attack brought on by climatic conditions, especially drought, that favour the Aleurodid.

CHERIAN (M. C.) & KYLASAM (M. S.). **Preliminary Notes on the Parasites of the Spotted and the Pink Bollworms of Cotton in Coimbatore.**—*Proc. Indian Acad. Sci.* Sec. B **14** no. 6 pp. 517–528, 10 refs. Bangalore, 1941.

The parasites that attack the spotted bollworms, *Earias fabia*, Stoll, and *E. insulana*, Boisd., in Coimbatore vary to some extent with the food-plant on which the latter occur. Larvae on cotton are parasitised by *Microbracon lefroyi*, D. & G., *Rhogas aligharensi*, Qadri, an undescribed species of *Microdus* (*Bassus*), *Elasmus johnstoni*, Ferrière, and *Actia hyalinata*, Mall. *Microbracon lefroyi* is active in November–February and lays its eggs on the larvae in batches of 5–10. In the laboratory, eggs were laid only on hosts enclosed in a cell. The larvae hatch in 18–24 hours and attach themselves to the host. They become full-grown in about 3 days and pupate in cocoons close to the host ; the adults emerge a week later. This Braconid has also been bred from *Adisura atkinsoni*, Moore, in pods of beans, *Rabila frontalis*, Wlk., in cotton bolls and *Earias* spp. in capsules of bhindi [*Hibiscus esculentus*], but not from *Earias* spp. in capsules of *H. vitifolius*, *Abutilon hirtum* or *A. indicum*, even when these plants were close to cotton. *Rhogas aligharensi* is most active in December–January and

pupates within the body of the host ; development lasts about a week, and only one parasite emerges from each host. It also parasitises *Earias* spp. in *H. esculentus*. *Microdus* is present in the adult stage in January and has not been recorded from other Provinces. It pupates within the body of the host larva, and the adult emerges from the host cocoon. *Elasmus johnstoni* is rarely found in bollworms attacking cotton or *H. esculentus*, but occurs throughout the year as an ectoparasite of the larvae of *Earias fabia* in capsules of *H. vitifolius*. In the field, 7–10 parasites emerge from each host, but up to 98 were obtained from one host in the laboratory. The life-cycle lasts 10–12 days. *Actia hyalinata* was obtained only from *Earias* spp., and not more than two individuals from each host. The larva leaves the host to pupate, and the adult emerges a week later. *Earias fabia* in the capsules of *H. vitifolius*, *Abutilon indicum* and *A. hirtum* is parasitised by *Microbracon greeni*, Ashm., which is the most important, *Elasmus johnstoni* and *Polyodaspis compressiceps*, Duda, and in *H. esculentus* by *Goryphus* (*Melcha*) *nursei*, Cam., *Microbracon lefroyi* and *M. hebetor*, Say. This last was also observed parasitising larvae of *Antigastra catalaunalis*, Dup., in gingelly [*Sesamum orientale*], and *Stomopteryx nerteria*, Meyr., in ground-nuts.

The parasites of *Platyedra gossypiella*, Saund., on cotton are an undescribed Bethylid of the genus *Goniozus*, *Apanteles pectinophorae*,* and *Microbracon gelechidiphagus*, Ram. Ayyar. *Goniozus* appears in November, but is not numerous until May–June, when it attacks the larvae infesting the flowers of cotton. It parasitised 49 per cent. of the larvae in flowers in July 1940. The adults feed on thrips and young larvae in the flowers and on the nectar, and lay their eggs on larvae in the fourth and fifth instars. The eggs hatch in 56–72 hours, and the young larvae at once begin to feed on the host. The pupal stage and the complete life-cycle last about 7 and 12–15 days, respectively. *A. pectinophorae* develops within the host, but leaves it before pupating and spins its cocoon within that of the host. *M. gelechidiphagus* parasitises larvae in the later instars in cotton bolls and appears very late in the season. It has also been bred from *Earias fabia* and *E. insulana*.

Tables are given showing for various years the incidence of *M. lefroyi* and *M. greeni* in *E. fabia* and of *M. gelechidiphagus* in *P. gossypiella*. Other tables give the emergence records of the various parasites from their hosts.

FROGGATT (J. L.). **Entomological Notes.**—*New Guinea agric. Gaz.* **7** no. 4 pp. 298–300. Rabaul, 1941.

The fruit-piercing moths, *Othreis fullonia*, Cl. (*fullonica*, L.) and *Eumaenas* (*O.*) *salaminia*, Cram., which are generally distributed throughout the Territory of New Guinea, sometimes cause the loss of large quantities of *Citrus* fruits, and also attack bananas, tomatos and papayas. Larvae of *O. fullonia* recently defoliated the shade-trees, *Erythrina lithosperma*, *E. variegata* and *E. poeppigiana* in a cacao plantation about 30 miles from Rabaul ; since *Erythrina* spp. have also been defoliated in other parts of the Territory, their use as shade trees for crops will have to be reconsidered. The larvae pupated between webbed leaves on the trees, and the prepupal and pupal stages together lasted 14 days. The foliage of tobacco is damaged by the larvae of *Prodenia litura*, F., and *Plusia signata*, F., which can be controlled with derris dust, and the stems are bored by those of *Psara hipponalis*, Wlk., and *Gnorimoschema* (*Phthorimaea*) *heliopa*, Lower, which are usually found in the seed beds or attacking young plants soon after transplanting ; mounding the soil round the base of the plants encourages the development of new roots above the damaged stalk. The cutworm, *Cirphis unipuncta*, Haw., attacks tobacco seedlings at ground level but can be controlled by scattering a bait, consisting of 25 lb. bran or pollard, 1 lb. Paris green, 1 quart molasses, the juice of 6 lemons and enough water to

* The original description of this species has not been traced, and it is not known whether it has been published.—*Ed.*

make the mass damp but crumbly, along the rows of plants in the late afternoon. A list is given of 11 Trypetids that have been collected or bred from infested fruit and one from leaf mines in *Aralia* sp. Banana has been attacked by Dynastids of the genus *Papuana*, including *P. woodlarkiana* var. *laevipennis*, Arr., which may kill many newly planted suckers by feeding on the growing point, particularly in dry weather, the weevil borer, *Cosmopolites sordidus*, Germ., which is comparatively rare at low levels, and the Pyralid, *Nacoleia* (*Lamprosema*) *octasema*, Meyr., the larvae of which feed on the fruit surface, usually affecting only its appearance.

Nezara viridula var. *smaragdula*, F., breeds freely on cowpeas, rice and other crops, and may be one of the pests that cause " whitehead " of rice by feeding on the ear when the grain is forming. The eggs are laid in masses of as many as 119 on the leaf and hatch in 4–6 days ; the nymphal stage lasts 27–28 days.

Insect Pests.—*Agric. Gaz. N.S.W.* **52** pt. 12 pp. 646–650, 6 figs. Sydney, 1941.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **30** 397] includes notes on summer control measures against Coccids and mites on *Citrus*. Satisfactory control of the white louse scale [*Prontaspis citri*, Comst.], the bud mite [*Eriophyes* sp. (? *sheldoni*, Ewing)] and to a less extent the purple scale [*Lepidosaphes beckii*, Newm.] is achieved by a thorough mid-winter application of lime-sulphur [*cf.* **30** 231], but this spray is not effective against the other pests. Both the mite and the white wax scale [*Ceroplastes destructor*, Newst.] can be controlled by lime-sulphur (1 : 40), applied about mid-December, using a suitable calcium-caseinate spreader at the rate of 1 lb. to 80 gals. Where infestations are particularly heavy, a second application should be made after a fortnight. This spray also checks *L. beckii*, but for efficient control of the latter a spray of white oil (1 : 40) is necessary in late February ; if *C. destructor* has not been effectively controlled, sodium carbonate (10–12 lb. washing soda per 40 gals.) should be added to the white oil. Lime-sulphur is likely to injure the trees if Bordeaux mixture has been applied as a fungicide during the same season. Heavy infestations of the red scale [*Aonidiella aurantii*, Mask.] or *L. beckii* require two applications of the white-oil spray, one in mid-December and one in mid-February. This programme usually gives good control of the rust mite [*Phyllocoptruta oleivorus*, Ashm.] and also of *C. destructor* if the first application is made when most of the young scales are still on the leaves and before they migrate to their permanent positions on the twigs. It is usually practicable to combine the white oil with the second or third application of Bordeaux mixture for the control of black spot. The brown scale [*Saissetia oleae*, Bern.] can be controlled by white oil (1 : 40) applied during December, and this spray should also control severe infestations of *C. destructor*, but where the latter is allowed to develop, sprays of white oil and sodium carbonate should be applied in February or March. About 10 lb. soda per 40 gals. is necessary if the scale is in the " peak " stage in February, and up to 15 lb. when it is well developed in March. If white oil is not required for other purposes, soda can be used with a spreader, such as soap (2 lb. to 40 gals.) or red oil (1 : 80). Soda sprays should not be applied in hot weather or to trees suffering from lack of moisture. Heavy applications of soda in late sprays may cause injury to fruit and trees, while sprays of soda alone or with oil following Bordeaux mixture may cause a certain amount of tree injury. The latter difficulty is overcome in some districts by the use of resin-soda which is much safer in this respect.

Under normal conditions a routine winter spray of lime-sulphur (1 : 15) and two applications of white oil (1 : 40), the first in mid-December and the second in mid-February, should keep coastal *Citrus* trees commercially free from the commoner pests. Recent tests indicate that the strength of the first white-oil spray can be reduced to 1 : 60, or even 1 : 80, provided that the application is thorough.

A brief description is given of the adult of *Aegeria tipuliformis*, Cl., which is widely distributed on currants, gooseberries and raspberries in New South Wales, together with notes on its bionomics and on measures for its control, which are similar to those noticed from Victoria [**24** 93].

Report of the Waite Agricultural Research Institute, South Australia 1939–1940. 83 pp., 3 pls. Adelaide, 1941.

A section of this report (pp. 35–39) deals with work on insect pests in South Australia during 1939 and 1940 and contains a survey of recent investigations on *Chortoicetes terminifera*, Wlk., and *Austroicetes cruciata*, Sauss. [*cf. R.A.E.*, A **28** 332, 593]. *A. cruciata* was abundant in 1939, and large numbers of eggs were laid in early summer. Though hatching was heavy in September 1940, the outbreak declined rapidly owing to the drought, which caused most of the hoppers to die from lack of food; many of those that became adult did not oviposit. Birds preyed heavily on hoppers that congregated in depressions where there was green herbage. In New South Wales, the population was similarly reduced by widespread drought. Laboratory experiments carried out to determine how the eggs remain viable in the soil from November until the following September showed that they go into diapause, in which state they strongly resisted loss of water and would not develop normally when transferred to favourable conditions of temperature (16–32°C. [60·8–89·6°F.]) and humidity. The retarding effect on the growth of the embryo of the factors causing diapause gradually decreases during the summer, slow development taking place up to about the end of April, and is finally eliminated early in June, after which the eggs develop and hatch normally if placed in suitable conditions of temperature and moisture. Eggs were collected in the field throughout the year and incubated under favourable conditions; none of those collected before 29th May hatched, while 66 per cent. of those collected soon after this date and all those collected on 19th June or later did so. Field observations showed that areas in the grasshopper belt in which the natural flora has been destroyed become favourable breeding grounds for this species if the soil is suitable.

The larvae of the Hepialid, *Oncopera fasciculata*, Wlk. [*cf.* **30** 316] and the Tineid, *Philobota productella*, Wlk., cause bare patches in pastures, the former in restricted districts round Mount Gambier and the latter in areas with good rainfall. The two species may occur together. The adults of *Oncopera* emerge by early October and those of *Philobota* during November, and damage to the pastures becomes evident about 7 months later. Spraying with lead arsenate, and in the case of *Oncopera*, cultivating affected patches when they are first observed, have given satisfactory control. Grape-vines in irrigated settlements on the River Murray were attacked by *Tenuipalpus californicus*, Banks, which webs the lower surface of the leaves, damages the fruit and the spurs and appears to overwinter in cracks in the bark or at the base of buds and short spurs. Gladiolus should be protected from *Taeniothrips simplex*, Morison, by storing only dry corms, which should be placed in paper bags containing 1 oz. naphthalene per 100 corms for about three weeks, and by treating the plants once or twice a week during the growing season with a spray of 8 oz. brown sugar, 2 oz. tartar emetic and 3 gals. water. *Onychiurus fimetarius*, L., frequently occurs in large numbers in damp soils rich in humus and is often associated with millepedes; both pests may seriously damage seedlings. Treatment of the soil with a fumiant such as carbon bisulphide has given effective control.

An inspection of representative grocery stores and bakeries showed that the larvae of *Ephestia kuehniella*, Zell., and *Plodia interpunctella*, Hb., occasionally infest prepared cereals and dried fruits packed in paper containers and also occur in storage bins used for flour, bran and pollard. *Oryzaephilus surinamensis*, L., was found on imported dates. *E. kuehniella* is the most serious pest in flour mills, where its characteristic larval webbing impedes the movement of the

flour through chutes, etc. *Tribolium castaneum*, Hbst., and *T. confusum*, Duv., are common, but do not appear to be harmful in the mills ; if they oviposit in the flour, however, infestation will develop when it is in storage. Mills should be kept clean, and fumigated at least once a year, and machinery liable to harbour infestation should be fumigated weekly.

It is stated in another section of the report (p. 17) that *Heliothis armigera*, Hb., caused considerable loss of seed of flax grown in experimental plots for the production of linseed oil. The average loss on all plots was 26·9 per cent. ; varietal differences in the percentage of seed damaged were not significant.

MARSHALL (Sir G. A. K.). **New injurious Curculionidae (Col.) from the Sudan.**—*Bull. ent. Res.* **33** pt. 1 pp. 1–3. London, 1942.

The new species described in this paper, all of which were taken on cotton in the Anglo-Egyptian Sudan, are *Smicronyx gossypii*, which also occurs in Eritrea, *Sibinia vitticollis*, *S. brunnula* and *S. sudanica*. *S. vitticollis* was also found on *Cajanus cajan* (*indicus*), *Eclipta alba*, *Acacia arabica*, clover and senna [*Cassia acutifolia*], *S. brunnula* on *Acacia arabica* and *S. sudanica* on *Sorghum*, *Cassia fistula*, *Grewia flavescens*, *Abutilon glaucum* and senna.

JONES (M. G.). **A Description of *Aphis* (*Doralis*) *rumicis*, L., and Comparison with *Aphis* (*Doralis*) *fabae*, Scop.**—*Bull. ent. Res.* **33** pt. 1 pp. 5–20, 7 figs., 19 refs. London, 1942.

In view of the confusion that exists between the two black Aphids that occur on dock (*Rumex*), one of which is polyphagous and of considerable economic importance and the other monophagous [*R.A.E.*, A **27** 673], studies were carried out in England on their comparative morphology and bionomics. After reviewing the early literature and records, the author concludes that the monophagous Aphid is *Aphis rumicis*, L., and the polyphagous one *A. fabae*, Scop., and gives characters separating colonies and individuals of the two species ; the edges of leaves of *Rumex obtusifolius* infested by *A. rumicis* curl under towards the mid-rib [*cf.* **10** 506], even though only three or four individuals are present, whereas those infested by *A. fabae* do not. All the adult forms of *A. rumicis* are described and figured, and the ways in which they and the eggs differ from the corresponding forms of *A. fabae* are indicated in tables. There is no distinct gynopara, as there is in *A. fabae*.

A. rumicis is recorded from central England, East Anglia and Wales. If infestation on any one plant is heavy, the apterous females migrate to other plants, but remain only on *R. obtusifolius* and *R. hydrolapathum* ; they have been recorded on *R. maritimus* in continental Europe. In normal years, this Aphid is commoner on dock than is *A. fabae*. The overwintering eggs, which are deposited on the leaf-bases and on small plants near the food-plant, hatch in April. The young fundatrices, which complete their development in about three weeks, are found only on the inner leaves of *R. obtusifolius*. They mainly produce apterous individuals. Alates appear in large numbers during May–August, but their production ceases towards the end of September, and the sexuparae and their offspring are apterous. The sexuparae appear early in October. The earlier examples give rise to parthenogenetic viviparae, oviparae and males, all of which can be produced by the same female, but the later ones produce chiefly males and oviparae.

In an attempt to establish *A. rumicis* on other food-plants, alate or apterous viviparous females were transferred from *R. obtusifolius* or *R. hydrolapathum* to uninfested *Euonymus europaeus*, beet, broad beans (*Vicia faba*), *Viburnum opulus* and *R. obtusifolius* ; colonies were established only on *R. obtusifolius*. These results were confirmed in further experiments in which uninfested beans, beet, *Cirsium arvense*, *Euonymus europaeus*, *Papaver rhoeas*, *Chenopodium*

album, *Arctium lappa* and *R. obtusifolius* were planted round infested plants of *R. obtusifolius* and caged. In the laboratory, alatae of *A. rumicis* were found to be significantly responsive to the odour of the flowers and leaves of *R. obtusifolius*, whereas those of *A. fabae* were not.

Hinton (H. E.). **Notes on the Larvae of the three common injurious Species of** *Ephestia* **(Lepidoptera, Phycitidae).**—*Bull. ent. Res.* **33** pt. 1 pp. 21–25, 1 pl., 15 figs., 3 refs. London, 1942.

Larvae of *Ephestia kuehniella*, Zell., *E. elutella*, Hb., and *E. cautella*, Wlk., are all serious pests of stored products, but they vary in importance, resistance to fumigation, etc., and since they frequently occur in association, it is desirable to be able to distinguish between them. This was hitherto possible only by rearing them to the adult stage, but the author shows that the mature and nearly mature larvae can be distinguished by the use of a hand lens and the smaller larvae with a microscope. Keys are given to the mature or nearly mature larvae and to the first-instar larvae of all three species and of *Plodia interpunctella*, Hb., which is frequently associated and confused with species of *Ephestia*. Slight differences are also recorded between larvae of *E. figulilella*, Gregson, and *E. cautella*, but they are based on examination of a single larva, believed to be mature, of the former, and it is considered doubtful whether they would prove constant if a series of specimens were examined.

Bryant (G. E.). **Notes on the Genus** *Pagria* **(Eumolpinae, Coleopt.).**—*Bull. ent. Res.* **33** pt. 1 pp. 31–34, 3 figs. London, 1942.

Descriptions are given of three new species of *Pagria*, of which one, *P. vignaphila*, attacks the leaves of cowpea in New Britain, together with lists of the African, Oriental and Australian species arranged in morphological groups, and of species that have been taken on cultivated plants and submitted to the Imperial Institute of Entomology for identification.

Vinson (J.). **Biological Control of** *Diatraea mauriciella*, **Wlk., in Mauritius. I. Investigations in Ceylon in 1939.**—*Bull. ent. Res.* **33** pt. 1 pp. 39–65, 7 figs., 9 refs. London, 1942.

In view of the serious damage caused to sugar-cane in Mauritius by *Diatraea mauriciella*, Wlk., the correct name for which is stated in an editorial footnote to be *Proceras sacchariphagus*, Bojer [see next abstract], surveys of the natural enemies of *P.* (*D.*) *venosatus*, Wlk., which was erroneously believed to be identical with it, were made in Ceylon in 1938–39 with a view to introducing them into Mauritius. As, however, *P. venosatus* was very scarce in Ceylon, attention was transferred to parasites of *Chilo zonellus*, Swinh., which attacks maize and is similar in size to *P. sacchariphagus*. The bulk of this paper comprises a detailed account of these investigations and of the subsequent introduction, rearing and liberation in Mauritius of the parasites obtained, the results of which have been briefly noted elsewhere [*R.A.E.*, A **29** 609; **30** 394], but short accounts of investigations leading to the separation of *P. venosatus* from *P. sacchariphagus* [see next three abstracts] and of the introduction of *Trichogramma evanescens*, Westw., from Ceylon [*cf.* **29** 610] are also included.

The parasites obtained were *Xanthopimpla stemmator*, Thnb., *Microbracon* (*Bracon*) *albolineatus*, Cam., *Macrocentrus* sp. and *Apanteles flavipes*, Cam. The adults of the first three species are described, a re-description of those of the fourth species is quoted, and notes are included on the bionomics of the three identified species, with records of their distribution and hosts, and on the technique of rearing and shipping the two that were taken to Mauritius. *Macrocentrus* could not be studied as the three adults obtained from collected material

were males. It is a larval parasite and spins its cocoon in the tunnel of the host. Larvae of *C. zonellus* were also attacked by the fungus, *Cephalosporium indicum*.

Eggs of *X. stemmator* are deposited singly in the pupae of the host; they probably hatch in a few hours, and the larval and pupal stages last about 10 days and a week, respectively. At Peradeniya, the total life-cycle occupied 16–19 days in February and March. The females began to oviposit 10–12 days after emergence and survived for 30–60 days in the laboratory, whereas males survived for only 20–40 days. Seven females from material collected in the field produced a total of only 35 offspring, but a dissected female contained 14 mature eggs in addition to immature oöcytes. Females oviposited in pupae of *Tiracola plagiata*, Wlk., *Prodenia litura*, F., and *Sesamia inferens*, Wlk., but adult parasites were obtained only from *S. inferens*. Pupae of *Chilo zonellus* were attacked only when they were placed in pieces of maize stalk or wrapped in muslin, and second-generation females of *X. stemmator* oviposited in confinement only sparingly and sometimes not at all. In Mauritius, pupae of *Proceras sacchariphagus* were not available, and pupae of *Sesamia vuteria*, Stoll, and *Simplicia inarcualis*, Gn., were offered to the parasites; only one pupa of *Sesamia* was attacked. This parasite has become well established in the Island following liberations [**30** 394], but as the adults are readily attracted to sugar-cane foliage sprayed with sugar solution, it is concluded that melliferous plants suitable for it are not present in Mauritius.

Eggs of *Microbracon albolineatus* are deposited, usually in groups of 2–8, on any part of the host larva, which is generally killed by the female parasite. In Ceylon, at an average temperature of 27°C. [80·6°F.] they hatched after about 24 hours, the larvae were fully-grown after 4 days, and the adults emerged 10–12 days later. The larvae feed externally and pupate in the tunnel of the host. The females began to oviposit 1–3 days after emergence; some survived for 30–32 days and produced about 50 offspring each, but many died after a week or less, and 15 days was regarded as a satisfactory mean. The maximum survival of the males was 15 days. The adults were captured chiefly on castor [*Ricinus communis*] near maize fields, and rarely on maize. Of six larvae of *Spodoptera mauritia*, Boisd., exposed to the parasites, three were attacked, but only one or two of the resulting larvae reached the cocoon stage; larvae of *Prodenia litura* and *T. plagiata* were not attacked. In Mauritius, the parasite was reared on *Proceras sacchariphagus* and *Sesamia vuteria*. Its failure to become established there [**30** 395] is believed to be due chiefly to the unsuitability of the food-plant of the host, since it was found in the laboratory that the pupae were destroyed by the excessive moisture and mould that result from the decaying sugar-cane shoots, but which are not produced in the more durable maize stalks. The presence of predacious spiders may also be a contributing factor.

Adults of *A. flavipes*, which already occurred in Mauritius as a parasite of *P. sacchariphagus* and was therefore not studied in any detail, generally survived only six or seven days and did not attack larvae of *C. zonellus* in confinement. As many as 60–75 parasites were found infesting a single host larva, but the usual number was 20–25.

TAMS (W. H. T.). **Note on the Name of the Sugar-cane Borer of Mauritius (Lep., Pyral.).**—*Bull. ent. Res.* **33** pt. 1 pp. 67–68. London, 1942.

The Pyralid borer that is injurious to sugar-cane in Mauritius was described as *Proceras sacchariphagus* by Bojer in 1856, as *Borer saccharellus* from Réunion by Guenée in 1862 and as *Chilo mauriciellus* by Walker in 1863. The author considers that the Government Report in which the name *P. sacchariphagus* was proposed is a valid publication and that this name is therefore the earliest available one. In describing the species as *Borer saccharellus*, Guenée supposed

that he had before him the American *Phalaena saccharalis*, F., and that he was erecting a new genus for the latter, which was, however, already the type of *Diatraea*, Guilding. He suggested the name *saccharellus* as an emendation for *saccharalis*. The structure of the genitalia of both sexes indicates that the Old World species of this group belong to a genus different from *Diatraea*, and the author considers that they are all referable to *Proceras*. He agrees with J. Vinson's view that *D. striatalis*, Sn., is identical with *P. sacchariphagus*, Bojer, but not with *P. venosatus*, Wlk. [see next abstract].

Vinson (J.). **Rectification d'une erreur courante relative à l'espèce de** *Diatraea* **(borer ponctué) s'attaquant à la canne à sucre à Maurice.**—*Rev. agric. Maurice* **20** no. 3 pp. 148–153, 7 refs. Port-Louis, 1941.

In the course of a discussion of the nomenclature of the Pyralid borer that attacks sugar-cane in Mauritius, where it was first observed in 1850, the author states that he does not regard the Report in which the name *Proceras sacchariphagus*, Bojer, was proposed as a valid publication and that in his opinion the earliest available name for the species is *Diatraea mauriciella*, Wlk. [see preceding abstract]. It was supposed to have been introduced from Ceylon in 1848, when sugar-cane cuttings were received in Mauritius from that island. Further cuttings were, however, received from Java in 1850. In 1941 the author compared the male genitalia of specimens from Mauritius, Ceylon and Java with diagrams published by B. D. Gupta of those of *P.* (*D.*) *venosatus*, Wlk., from India. The species in Java had been described as *Diatraea striatalis*, Sn., but had subsequently been considered by various workers to be *P.* (*D.*) *venosatus*. As a result of the comparison, the author concludes that the species in Ceylon and India is *P. venosatus* and that the species in Java is *P. sacchariphagus*, which was introduced into Mauritius from that island. There are slight differences in the genitalia of both sexes between the specimens from Java and Mauritius, but these are not considered of specific importance and are thought to have arisen as a result of isolation and inbreeding of the moth in Mauritius. Similar conclusions as to the distinctness of the Javan species from *venosatus* have been reached by A. Diakonoff [see next abstract].

Diakonoff (A.). **De gestreepte stengelboorder van Java en de "borer ponctué" van Mauritius.** [The Striped Stem-borer of Java and the "borer ponctué" of Mauritius.]—*Arch. Suikerind. Ned. & Ned.-Ind.* **2** no. 13 pp. 318–321. Pasoeroean, 1941.

From a comparison of the genitalia of specimens of *Proceras sacchariphagus*, Bojer (*Diatraea striatalis*, Sn.) from Java and *P.* (*D.*) *venosatus*, Wlk., from India, the author concludes that they are distinct species. He follows, however, the nomenclature of J. Vinson and summarises the latter's paper on the subject [see preceding abstract].

Jayaratnam (T. J.). **The Bethylid Parasite** (*Perisierola nephantidis* **M.**) **of the Coconut Caterpillar** (*Nephantis serinopa* **Meyr.**).—*Trop. Agriculturist* **97** no. 3 pp. 115–125, 1 pl., 3 refs. Peradeniya, 1941.

The Bethylid parasite of *Nephantis serinopa*, Meyr., recorded in the eastern coconut areas of Ceylon as *Perisierola* sp. [*R.A.E.*, A **29** 621] and since identified as *P. nephantidis*, Mues., was found to be the predominant larval parasite of *N. serinopa* in an outbreak in one of the northern coconut areas in 1941. The author gives the results of observations on its bionomics [*cf. loc. cit.*] and discusses its value. The adults paired about 24 hours after emergence, and the females began to oviposit soon afterwards, usually on third- or fourth-instar larvae, laying 1–15 eggs on a single host. The average number of eggs laid

by females was 19, and the average length of life of the adult was 17 days. The complete life-cycle lasted 11½–15 days. The only parasite of the Bethylid recorded in Ceylon is *Ceraphron* (*Calliceras*) sp., which appears to attack the prepupal stage only. The life-cycle and length of adult life of the hyperparasite are 15 and up to 14 days, respectively; several females often attack a single cocoon of *Perisierola*.

Factors that make it probable that *Perisierola* can become of value in the control of *Nephantis* are its short life-cycle, which enables it to pass through three or four generations during a single generation of the host, the fact that it can attack the host over a relatively long period in its development, from the third to the fifth larval instars, and probably attacks additional larvae for feeding purposes, the activity of the adults in dispersing and finding hosts, the high ratio of females to males (3 : 1), and the absence of any tendency to superparasitism. Its effectiveness is unlikely to be reduced appreciably by the hyperparasite, but it is very susceptible to extremes of humidity and to high temperatures, and it will probably give effective control only of limited outbreaks of the pest that occur in regions where the change from the wet to the dry season is relatively gradual. Conditions are favourable to it over a longer period during the year in the northern district than in the eastern one.

Bellod (M.). **Contribución al conocimiento de la biología y morfología de *Aglaope infausta* L.** [A Contribution to the Knowledge of the Biology and Morphology of *A. infausta*.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 81–97, 22 figs., 2 refs. Madrid [1942].

An account is given of field and laboratory investigations in 1941 on the bionomics of *Aglaope infausta*, L., on almond in a relatively cold district in the Province of Valencia. The egg and larva of this Zygaenid are described. It has one generation a year and hibernates in the larval stage [*cf. R.A.E.*, A **22** 609]. The larvae resumed activity in early March, feeding on the leaves until just after mid-May, when they pupated in twig forks, on the bark, and occasionally on the leaves. In the last instar the larvae were very voracious and left only the leaf-veins. The adults emerged in mid-June and were present for a fortnight. Eggs were observed from mid-June to mid-July, and young larvae were present on the leaves on 10th July. After feeding for about a month they entered their hibernation quarters under the bark of the trunks and branches. Four females, each confined with a male, laid 214, 284, 321 and 400 eggs, respectively.

Bellod (M.). **Experiencias sobre los tratamientos de invierno contra la oruga del almendro (*Aglaope infausta* L.).** [Experiments on Winter Spraying against the Larvae of *A. infausta* infesting Almond.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 98–109, 3 figs., 3 refs. Madrid [1942].

Almonds in the arid, non-irrigated regions of eastern Spain, especially in the Provinces of Murcia and Alicante, are severely attacked by *Aglaope infausta*, L. Since the control of the hibernating larvae by a method that involves scraping the bark [*cf. R.A.E.*, A **22** 609] is relatively costly, experiments were carried out on the value of winter insecticides. Five combinations were tested, but the only one to give satisfactory results was a mixture of 1 gal. tar oil, 30 lb. quick-lime and water to make 10 gals., which gave 96·2 per cent. mortality as compared with untreated trees. The mixture is prepared by gradually adding sufficient water to slake the lime, mixing the tar oil with the resultant paste, and then stirring in the remainder of the water. It should be well brushed on to all rough bark, care being taken to fill all the cracks. It is suggested that the application be made during the ten days after the almond trees begin to flower, since the appearance of the larvae generally coincides with that of the

first leaves. No injury to the trees was observed, but the liquid should not be allowed to come into contact with the buds or to run down the trunk to the roots.

Planes (S.). **Grave enfermedad del tomate, producida por un ácaro del género** *Phyllocoptes*. [A serious Disease of Tomato due to a Mite of the Genus *Phyllocoptes*.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 148–156, 6 figs., 4 refs. Madrid [1942].

In 1940, a serious affection of tomatos appeared in humid coastal regions of Valencia. The lowest leaves turned yellow, with a metallic sheen on the underside, the discoloration then extended to the leaf-stalks, branches and fruit, and finally the whole plant withered, crop losses of 50–80 per cent. being recorded. Examination of affected plants in 1941 showed the underside of the leaves to be heavily infested by an Eriophyid of the genus *Phyllocoptes*. This mite is described in some detail, and it is concluded that it is probably a subspecies or variety of *P. destructor*, Keifer. It was not observed on the fruit, and oranges growing near tomatos were not infested. The tomato plants had been dusted with sulphur, but the method used deposited the sulphur on the upper leaf-surface; and the mites on the underside were not affected. Satisfactory control was obtained by dusting the underside of the leaves, many plantations being saved by three applications at intervals of a fortnight. Spraying with lime-sulphur was less effective.

Ruiz Castro (A.). **El " melazo "** (*Pseudococcus citri* **Risso**) **en los parrales de Almería.** [*P. citri* in the Vineyards of Almeria.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 157–216, 56 figs., 2 maps, 3 diagr., 4 pp. refs. Madrid [1942].

An account is given of the morphology of all stages, synonymy and distribution of *Pseudococcus citri*, Risso, which is the chief pest of grape-vines in the coastal regions of Almeria, in Spain. The injury becomes noticeable in August and the mealybug is extremely abundant in September. The leaves, shoots and grape clusters become covered with honeydew on which a sooty mould develops.

The duration of development depends on temperature and is very variable. In vineyards near the coast there are four overlapping generations a year, and the hibernating generation becomes active in the second half of April. The first generation completes its development early in July. The second develops in July and the first half of August, and the third from mid-August to the end of September, producing a fourth that overwinters from the end of October. Both the adult females and the immature Coccids survive the winter, and development is not entirely suspended.

Lists are given of the natural enemies observed in Almeria ; these comprised 11 predacious insects, of which the most important was the Hemerobiid, *Nefasitus fallax*, Navás, and the Encyrtid parasites, *Anagyrus bohemani*, Westw., *Leptomastidea abnormis*, Gir., *Prochiloneurus bolivari*, Merc., and *Signiphora conjugalis*, Merc., of which the first two are the more important. The results obtained from releasing the imported Coccinellid, *Cryptolaemus montrouzieri*, Muls., were disappointing. The control of the mealybug by means of insecticides is discussed at some length. Fumigation under tents is impracticable on vines, and petroleum-oil emulsions are deleterious to them. From tests of a considerable number of sprays and washes, the author recommends the following treatments. In winter, the stems and branches should be brushed with a well agitated mixture of 30 lb. quick-lime, 10 lb. gas-works tar and water to make 10 gals. The shoots and roots should not be wetted. The extra cost of scraping the bark before treatment is not warranted by a corresponding increase in efficiency. The application is best made in December or the first half of

January. For dormant treatment at a later date, the formula recommended is 8 lb. quick-lime, 4 lb. tar, and water to make 10 gals. Summer spraying is desirable for medium infestations and is a necessary complement to winter treatment for severe ones. The spray used should contain 12 oz. nicotine, 7½ lb. soft soap, 1 lb. sodium carbonate, 2½ gals. methylated spirit and 50 gals. water, and should be applied in June to the scraped bark. A second application should be made 3 weeks later, and a third to protected sites if necessary.

DEL CAÑIZO (J.). **Pulverización de árboles frutales. (Datos prácticos.)** [Practical Data on spraying Fruit Trees.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 217–224, 1 fig., 12 refs. Madrid [1942].

In order to encourage the use of insecticides and fungicides on fruit trees in Spain, notes are given on the technique of spraying and the sprays that are commonly recommended against insect and fungous pests. The principal insects dealt with are *Cydia pomonella*, L., on apple and pear; *Hyponomeuta padellus*, L., on apple and plum; *Aglaope infausta*, L., on almond; and *Chrysomphalus dictyospermi*, Morg., *Lepidosaphes* (*Mytilococcus*) *beckii*, Newm., and *L.* (*M.*) *gloverii*, Pack., on *Citrus*. Arsenicals are used against the first three and mineral-oil emulsions against the Coccids.

GARCÍA-TEJERO (F. D.). **Distribución geográfica de las plagas del viñedo en España.** [The geographical Distribution of Vineyard Pests in Spain.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 225–232, 1 fldg. map, 2 pp. refs. Madrid [1942].

Records are given from the literature of the distribution in Spain of 14 insect pests of grape-vines other than *Phylloxera* [*vitifoliae*, Fitch], which is ubiquitous; most of the localities named are shown on a map.

BENLLOCH (M.). **Las invasiones de *Dacus oleae* Rossi y sus anomalías.** [Infestation by *D. oleae* and abnormal Variations in it.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 233–236. Madrid [1942].

As a preliminary to an attempt to forecast the intensity of the infestation of olives by *Dacus oleae*, Gmel., in Spain, the author divides the areas in which they are grown into three zones. The first, or endemic, zone, in which the fly is always present and causes serious injury each year, comprises coastal or other regions with a high relative humidity and moderate minimum temperatures. Injury is irregular, occasional and often negligible in the second zone, and always quite insignificant in the third, which comprises the colder districts. Infestation is difficult to forecast in the second zone, since the fly cannot maintain itself in it. Either the winter and spring are too cold to permit the survival of the hibernating pupae or the adults that emerge from them, or the summers are so hot and dry that the eggs shrivel or the larvae die soon after hatching. The infestation is maintained in these areas by immigration from the endemic zone. The second zone thus includes localities in which infestation can occur only at particular periods in the year. The fly has 3–4 generations a year in the endemic zone, and infestation passes regularly from the early to the late varieties of olive. If uninfested fruits become scarce, the fly migrates in search of such fruits for oviposition, and this migration may occur early or relatively late in the season, depending on the availability of uninfested fruits. The likelihood of migration can thus be determined by the degree of infestation in the endemic zone, and observation on temperature and humidity in non-endemic areas will show whether infestation in them is likely to be successful. Control measures should be applied accordingly.

Moreno Márquez (V.). **Experiencias sobre el poder atrayente, para la mosca del olivo, del fosfato amónico a diversas concentraciones.** [Experiments on the Attraction to the Olive Fly of Ammonium Phosphate at varying Concentrations.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 237–242, 2 graphs. Madrid [1942].

In view of the good results obtained with baits of ammonium phosphate against *Dacus oleae*, Gmel. [*R.A.E.*, A **29** 462], experiments were carried out in 1940 in an olive grove near Badajoz to determine the most effective concentration. The results showed that 2–4 per cent. solutions were more attractive than those at 6, 8 and 10 per cent. The greatest numbers of flies were taken in mid-July and early October, and there was an unaccountable fall in August and September.

Gómez Clemente (F.). **Influencia de la orientación, altura e iluminación de los mosqueros en la captura de la *Ceratitis capitata*. (Resumen de dos años de experiencias.)** [A Summary of two Years' Experiments on the Influence of Orientation, Height above the Ground, and Lighting of Bait-traps on the Capture of *C. capitata*.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 243–255, 4 figs., 2 refs. Madrid [1942].

The experiments described were made in 1935 and 1940 in orange plantations in Valencia with glass bait-traps containing 1·5 per cent. Clensel against *Ceratitis capitata*, Wied. The efficiency of the traps varied little with the side of the tree on which they were placed, though some evidence was obtained that traps on the south side were the most effective, and the data obtained when traps were suspended at heights of some 5, 3 and 1 ft. above the ground were inconclusive, but suggested that the height selected should be that at which the majority of fruits occur. In investigations on the effect of light, most flies were caught in traps placed on the exterior of the tree.

del Cañizo (J.). **El mosquito del trigo (*Mayetiola destructor* Say) y la época de siembra.** [*M. destructor* and the Date of Sowing.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 256–263, 3 figs., 10 refs. Madrid [1942].

Mayetiola destructor, Say, is a pest of wheat in several parts of Spain and late sowing in autumn is recommended against it. An unusually mild autumn, however, may result in prolonged emergence of the flies, and, if they are still present when the late-sown wheat appears, they prefer it because it is more tender than that sown earlier. This was the case in some districts in the Province of Jaén in 1939, when sowing was carried out from 10th October to mid-December and the late-sown crops were severely infested. Another reason for the heavy infestation was that the pupae of the spring generation had not been destroyed, owing to delay in clearing the stubble. The best date for sowing in a particular year cannot easily be ascertained, but late sowing is usually safe. Other measures advised are clearing the stubble, crop rotation with barley and the promotion of vigorous growth in the plants.

del Cañizo (J.). **Notas sobre el " sampedrito " del trigo.** [The Wheat Bug, *Eurygaster austriacus seabrai*, China.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 264–274, 5 figs., 12 refs. Madrid [1942].

A key is given to the five species of *Eurygaster* that occur in the Iberian Peninsula, together with a list showing their synonyms and forms. *E. maura*, L., damaged wheat in Galicia in 1935 and is considered a pest in Portugal, but the only species that is really injurious to wheat is *E. austriaca*, Schr., of which the typical form occurs in southern Portugal and subsp. *seabrai*, China, in the

south of the Province of Toledo in Spain. The latter is the undetermined Pentatomid previously recorded from Toledo [*R.A.E.*, A **26** 698], and its original description is reproduced. It has one generation in the year, and the adults overwinter beneath the ground litter of oak forests, or just below the surface of the soil of woods or thickets. They gradually resume activity in late February or March, and migrate to cereal fields in April. They pair and 3–4 days later deposit eggs on the underside of the leaves, barley usually being more attractive than wheat, since it develops earlier. They die 10–15 days after pairing. The nymphs hatch in 10–15 days and feed on the leaves and other green parts of cereals, wild grasses and other weeds, especially Malvaceae. The older nymphs attack the unripe seeds, those of wheat being preferred, since barley has usually passed the attractive stage. The adults emerge in June or early July, shortly before harvest, and migrate to winter quarters in August. There is considerable overlapping of the various stages owing to the prolonged period of migration and oviposition in spring. Late-sown crops are more infested than early ones, and the chief injury is that to the ears, which are formed about 20th–30th May. In June, varieties of wheat of which the seeds are still milky suffer severely. Infestation reduces not only the weight of the grains but also the quality of flour milled from it, and the disagreeable smell of the damaged grain and straw makes them unpalatable to poultry and cattle.

Benlloch (M.). **Aspecto económico de la lucha contra las plagas.** [The economic Aspect of Pest Control.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 275–288, 14 refs. Madrid [1942].

The author discusses the conditions under which chemical control measures against insect and fungous pests of crops are economically profitable and gives figures showing the cost of several typical treatments used in Spain.

Herce (P.). **La calidad de las aguas en la preparación de los caldos arsenicales.** [The Quality of Water in the Preparation of arsenical Sprays.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 289–318, 4 graphs, 1 ref. Madrid [1942].

Commercial preparations of lead and calcium arsenates contain small proportions of soluble arsenic (As_2O_3 and As_2O_5) that are injurious to plants, and these amounts are increased by reactions resulting from the presence of various salts in spray waters and from exposure to carbon dioxide in the atmosphere. The effect of water was measured in laboratory experiments in Madrid, a detailed account of which is given, in which nine salts that commonly occur in natural waters were added to distilled water and the resulting liquids used to prepare suspensions of the arsenates. In addition, suspensions were prepared with water from eight springs rich in salts. The results showed that the presence of certain anions in the water increases the percentage of soluble arsenic. For lead arsenates, these anions are CO_3H^- and Cl^-, while for calcium arsenate the former was the predominant one. Na^+, Ca^{++} and Mg^{++}, which are the usual cations in water, have no practical effect. The solvent effect of the anions was corrected in the case of calcium arsenate by the addition of lime (calcium hydroxide) according to a method that is described, but no corrective was found for use with lead arsenate.

Mendizábal-Villalba (M.). **Observaciones biológicas sobre noctuidos.** [Biological Observations on Noctuids.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 319–323, 4 figs., 1 diagr., 4 refs. Madrid [1942].

In Almeria, *Agrotis segetum*, Schiff., has a third, autumn-winter, generation, whereas only two have been recorded elsewhere in Europe. Adults emerged in November and December 1941 and January 1942.

Sugar-cane in Almeria was severely attacked in the summer of 1941 by larvae of *Sesamia vuteria*, Stoll; an unfertilised female that emerged in the laboratory laid eggs that gave rise to about 70 larvae. Parthenogenesis has not been previously known to occur in this moth.

Gómez Clemente (F.). *Taragama repanda* **(Hübner), sobre naranjo.** [*T. repanda* on Orange.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 324–331, 7 figs., 5 refs. Madrid [1942].

Groups of larvae of *Taragama repanda*, Hb., were observed defoliating small lots of orange trees near Valencia in July 1926 [*cf. R.A.E.*, A **14** 616] and again in the autumn of 1931. The larva, pupa and adults of this Lasiocampid and its distribution are described. The author is not aware of any previous records of it from *Citrus*, but in the laboratory the larvae preferred orange leaves to those of recorded food-plants. They fed only at night. No adults were present at the times when the larvae were taken, and the latter spun cocoons in the twigs soon after in the laboratory. The females that emerged deposited up to 100 eggs each in 1926, but only 50–60 in 1931. There are probably two generations a year, and the appearance of the cocoon suggests that hibernation occurs in the pupal stage. Owing to the sporadic nature of the infestation, hand-collection gave adequate control.

Cánovas (C.). **Las bandas colectoras como método complementario en la lucha contra la** *Cydia* (*Carpocapsa*) *pomonella* **L.** [Trap-bands as a complementary Measure against *C. pomonella*.]—*Bol. Pat. veg. Ent. agríc.* **10** (1941) pp. 332–340, 7 figs., 1 ref. Madrid [1942].

Cydia pomonella, L., causes serious damage to apple and pear in Spain, where it has 2–4 generations a year, depending on temperature, and investigations on its bionomics and control are being carried out in Valencia. This paper comprises a discussion of the preparation and use of trap-bands of corrugated paper as an adjunct to spraying with lead arsenate. Untreated bands can be used to indicate the appropriate times to spray against the larvae, while those dipped in a hot mixture of 1 lb. beta-naphthol and 1½ gals. lubricating oil of viscosity 17° Engler at 20°C. [68°F.] afford direct control of the larvae that enter them to pupate. Care should be taken in impregnating the bands that the ends of the corrugations do not become blocked. The bark of the trees should be scraped smooth and the bands applied in late May or June. They should be removed and burnt in December or January, since the toxicity of the chemical decreases with exposure to the weather.

Houser (J. S.). **Some troublesome Pests of Conifers.**—*Proc. 16th nat. Shade Tree Conf.* pp. 65–82, 5 figs. Detroit, Mich., 1940. [Recd. 1942.]

The author describes the damage caused in Ohio by a number of insects and a mite, and discusses methods of controlling them. They comprise *Paratetranychus ununguis*, Jac., *Thyridopteryx ephemeraeformis*, Haw., and *Chionaspis pinifoliae*, Fitch, on various conifers; *Dioryctria zimmermanni*, Grote, sawflies, particularly *Neodiprion lecontei*, Fitch, and *N. pinetum*, Norton, *Chermes pinicorticis*, Fitch, *Pissodes strobi*, Peck, and *Rhyacionia buoliana*, Schiff., on pines; *Chermes* (*Adelges*) *abietis*, L., and *C.* (*A.*) *cooleyi*, Gill., which attack spruce, but differ in that *C. cooleyi* requires the presence of Douglas fir [*Pseudotsuga taxifolia*] in the vicinity in order to complete its cycle; *Diaspis visci*, Schr. (*carueli*, Targ.), and *Dichomeris marginella*, F., on juniper [*Juniperus*]; *Recurvaria variella*, Chamb., on bald cypress [*Taxodium distichum*]; *Melanophila fulvoguttata*, Harr., on hemlock [*Tsuga*]; and *Pristiphora* (*Nematus*) *erichsoni*, Htg., on larch.

CORY (E. N.). **The outstanding Insects of Shade Trees in Maryland in 1941.**—*Proc. 17th nat. Shade Tree Conf.* pp. 108–109. Washington, D.C., 1941.

In 1941, adults of *Chalepus dorsalis*, Thnb., were first observed in Maryland on 8th May, on apple, and infestation of the black locust tree [*Robinia pseudacacia*] had spread all over the State by late summer [*cf. R.A.E.*, A **26** 549]. The defoliation caused by the leaf-mining larvae of this Hispid affected the growth of the trees, but did not kill them. Individual trees can be protected by spraying with 4 lb. lead arsenate and 1 lb. flour per 100 U.S. gals. water in early May against the first generation and about the middle of July against the second. In central Maryland, London planes [*Platanus*] were defoliated and in some cases killed by *Thyridopteryx ephemeraeformis*, Haw.; the larvae, which hatch from the overwintered eggs in early May, feed inconspicuously for nearly two months and then so voraciously that the tree may be partially defoliated within a few days. Control of *Popillia japonica*, Newm., by biological and other methods appears to be satisfactory [*cf.* **30** 189, etc.]. Pests of minor importance included *Paratetranychus ununguis*, Jac., and *Neuroterus niger*, Gill., both on oaks, and *Hyphantria cunea*, Dru., on hickory and walnut.

HAMILTON (C. C.). **Control of the Pine Sawfly, *Neodiprion sertifer* Geoff., with concentrated Lead Arsenate Sprays.**—*Proc. 17th nat. Shade Tree Conf.* pp. 110–118, 4 figs. Washington, D.C., 1941.

The author describes experiments carried out in New Jersey to determine whether concentrated sprays of lead arsenate applied with a power sprayer to woodland plantings of pine would give economical control of the sawfly, *Neodiprion sertifer*, Geoffr., the bionomics and distribution of which are briefly discussed [*cf. R.A.E.*, A **28** 486]. A spray containing 16 lb. of a proprietary dispersed lead arsenate per 100 U.S. gals. water with an adhesive and a spreader was applied at high pressure to 4-acre blocks of pine trees 25–30 ft. tall at the rate of about 75 U.S. gals. per acre on 13th and 14th May. It was directed into the air between the trees, was carried 100 ft. or more by the breeze and drifted down through the foliage, giving good coverage. The spray did not adhere well, but there was no rain during the test to wash it off, and examination on 21st and 25th May showed good distribution of the lead arsenate and practically complete kill of the sawfly larvae.

WOGLUM (R. S.) & LAFOLLETTE (J. R.). **Spraying Citrus Trees. Importance of residual Oil Film.**—*Calif. Citrogr.* **27** no. 4 pp. 94, 109, 1 fig. Los Angeles, Calif., 1942.

It is generally considered that mortality of Coccids on *Citrus* due to the sprays of highly refined lubricating oil used in California is largely the result of suffocation caused by oil penetrating through the tracheae, and that the amount of oil deposited on the leaves, fruit and branches and the length of time it remains are very important in the control of both Coccids and spider mites [*Paratetranychus citri*, McG.], since the residual film prevents newly hatched crawlers from becoming established and newly hatched mites from feeding [*cf. R.A.E.*, A **24** 779]. The permanence of the oil film depends directly on the heaviness or viscosity of the oil used. Oil sprays have given most effective control on fruit, foliage and young twigs, all of which have a natural waxy coating that retains the oil film well, but not on rough bark, because of absorption of the oil [*cf.* **24** 780]. Where wood is covered with scale insects, the heavier types of lubricating oil are essential for satisfactory results. The heavy oils used in early work on highly refined lubricating oils against *Citrus* pests gave excellent control of crawlers of the red and black scales [*Aonidiella aurantii*, Mask., and *Saissetia oleae*, Bern.] on heavily infested lemon trees and often gave more permanent control than fumigation, owing to the residual oil film, but the light oils used later at dosages of up to 3–4 per cent. were ineffective, and crawlers

became established a few days after application. Mites were controlled for nearly a year by a heavy oil used at a concentration of 2 per cent., but for only 2–3 months by a light oil at 4 per cent., and work with kerosene at 9–10 per cent. in 1941 showed that an oil film that will remain on the tree for some time is necessary for scale and mite control. The oil film is retained best in cool weather and on turgid plants, and it is dissipated by desert winds and high temperatures and on wilting trees, so that, for equivalent results, heavier oils are necessary in summer than in winter.

The recent tendency has been to use lighter oils to reduce injury to the plants, but the author points out that standards for oils that give a reasonable balance between insect control and tree damage have been established, and that any alteration in the standards that reduces the persistence of the oil film has usually resulted in poorer control of Coccids or mites.

Bissell (T. L.). **The Pale-striped Flea Beetle.**—*Circ. Ga Exp. Sta.* no. 130, 8 pp., 5 figs., 11 refs. Experiment, Ga., 1941.

There has been some confusion as to the scientific name of the beetle that is the subject of this paper. It is the species often recorded as *Systena taeniata*, Say, but D. H. Blake (1935) concludes that the latter is unrecognisable, and that the insect in question is *S. blanda*, Melsh., considered by some to be a colour variety of *taeniata*. It is not usually common in Georgia, where the adults feed normally on weeds and apparently prefer *Ambrosia trifida*, but they were abundant and damaged cotton and other crops over a considerable area of that State in May 1941. In most cases, however, they appeared in cotton fields before the first hoeing, and re-sowing was seldom necessary. As a result of their feeding, the superficial tissue of both surfaces of the leaves was destroyed, and white elongated patches appeared on the leaves. The cotyledons of cotton and bean plants were sometimes so severely attacked that they withered, and the buds of small cotton plants were often destroyed, even where there was little evidence of feeding on the older leaves. Newly-set pimento pepper [*Capsicum*] was also injured, but cowpeas close to infested plants were not attacked. A related species, *Systena elongata*, F., which is generally commoner in Georgia, though not abundant, attacks dahlia, ground-nut [*Arachis hypogaea*], cotton, cowpea, and *Xanthium* sp., but its feeding produces round and not elongated patches on the foliage.

Local damage by *S. blanda* to cotton in Georgia had been recorded in 1887, 1904, 1927 and 1940. In 1941, it occurred practically throughout May, but cotton attacked after the middle of the month outgrew the injury, and the beetles completely disappeared from crops and weeds during the first week of June. They are probably present on weeds in small numbers each year, but the immature stages have never been observed in Georgia. Infestation of cotton did not appear to be related in any way to the nature of the previous crops, and it is concluded that the occurrence of outbreaks is not influenced by the temperature, but that dry periods during autumn, winter and spring enable the populations to increase, since each of the recorded outbreaks was preceded by periods during which the rainfall was only 61–75 per cent. of the normal.

Control measures were not generally necessary during the outbreak. Those recommended are the destruction of wild food-plants throughout the year, delaying the first hoeing until the risk of attack is past, and, where older plants are attacked, the application of calcium arsenate as a dust or spray or in a mopping mixture of molasses and water.

Satterthwait (A. F.). **Weevils (Coleoptera, Curculionidae) affecting Chufa** (*Cyperus esculentus*).—*Ent. News* **53** nos. 1–2 pp. 11–16, 37–43. Philadelphia, Pa., 1942.

Surveys made in the Mississippi Valley and some of the eastern United States in the course of investigations on the weevils of the genus *Sphenophorus*

(*Calendra*) showed that chufa (*Cyperus esculentus*), which is grown over limited acreages as food for pigs, is a common food-plant of several species of weevils. These comprised *Barinus squamolineatus*, Csy., *B. curticollis*, Csy., *Barilepis grisea*, Lec., *Sibariops confusa*, Boh., *Sphenophorus callosus*, Ol., *S. destructor*, Chitt., *S. cariosus*, Ol., *S. parvulus*, Gylh., and *S. venatus*, Say, and brief notes are given on their bionomics. *C. esculentus* appeared to be the preferred food-plant of *S. callosus*, *S. destructor* and *S. venatus*, but the tubers are not attacked directly by insects. All these weevils can be controlled by the destruction of crop residues, by clean cultivation and by disturbing the soil deeply enough to destroy the crowns. Where practicable, all the tops of the plants should be destroyed before mid-winter, the ground should be smoothed and any plants left on the surface by the pigs should be burnt.

Barber (G. W.) & Pepper (B. B.). **The Corn Lanternfly in New Jersey (Homopt.: Fulgoridae).**—*Ent. News* **53** no. 1 p. 22. Philadelphia, Pa., 1942.

Peregrinus maidis, Ashm., rarely invades the northern United States, but in 1939 it was found on maize in New Jersey, where it had not previously been recorded. Infestations of light or medium severity were general during August and September, and by late autumn, populations of considerable size were observed on late sweet maize, though no infestation sufficient to cause serious injury to the plants occurred. This outbreak coincided with one of the most serious infestations of *Laphygma frugiperda*, S. & A., on maize yet recorded in the north-eastern United States. In 1940, *P. maidis* was observed only once in New Jersey, attacking plants of late sweet maize.

Fleming (W. E.). **Relative Effectiveness of Acid Lead Arsenate and other Materials as Stomach Poisons for the Larvae of the Japanese Beetle.**—*Tech. Bull. U. S. Dep. Agric.* no. 788, 32 pp., 1 fig., 30 refs. Washington, D.C., 1942.

The following is based on the author's summary. The work with different materials against larvae of *Popillia japonica*, Newm., in the laboratory was conducted in five-inch earthen pots of soil in chambers maintained at 80–85°F. At this temperature, tests could be completed in two weeks, whereas at 55–60°F. eight weeks would have been required. Tests were also made in beds in a greenhouse. As the larvae obtained at different seasons and in different fields were not constant in their susceptibility to the standard (freshly applied acid lead arsenate), each assay was based on parallel tests between the standard and the test material. The details of the procedure are described. In each series of tests, there were usually four independent sources of variation, namely, the composition of the materials, the rate of application, the random or experimental error, and the period for which the materials were exposed to weathering in the soil before testing. The analysis of variance was found to be the most satisfactory procedure for determining the significance of the difference in mortality caused by these factors. The amounts of the test materials that were equivalent to freshly applied lead arsenate at the rate of 1,000 lb. per acre to a depth of 3 ins. were estimated by interpolation of the larval survivals.

Some consideration was given to the effect of the physical and chemical properties of acid lead arsenate on its insecticidal action and to the persistence of the larvicidal action under experimental conditions. Regrinding the commercial material, alone or with gum arabic, significantly increased the percentage of the particles in the samples less than 2 microns in diameter and enhanced the effectiveness of the material as an insecticide. The total arsenic oxide content of the material did not appear to be a major limiting factor, provided that the material contained not less than 30 per cent. of arsenic oxide. Only a low

correlation was found between the quantity of soluble arsenic in the soil and the larval mortality. The lead content of the compound did not appear to be a factor in its insecticidal action.

Under the experimental conditions, the effectiveness of acid lead arsenate decreased so slowly that during the first year no significant difference could be determined. After this period the loss in insecticidal action was accelerated. This loss is attributed to leaching from the soil and to the conversion of the arsenical into a non-toxic form by reaction with the soil constituents. The determination of the arsenic and lead in the soil by chemical analysis may not be a reliable index of the possible effectiveness of the treatment in killing larvae, because so far it has not been possible to separate the effective from the inactive arsenic in the soil.

When freshly applied, the arsenates of calcium, magnesium and manganese appeared to be more effective against the larvae than acid lead arsenate ; the arsenates of aluminium, barium, ferric iron and zinc appeared to be equivalent to acid lead arsenate ; and basic lead arsenate was of no insecticidal value. The effectiveness of acid lead arsenate, ferric arsenate and zinc arsenate decreased rapidly after these arsenicals had been in the soil for 2–3 years. The effectiveness of the other arsenates appeared to last a year or two longer, but with the exception of basic lead arsenate these were more toxic to plants growing in the soil than was acid lead arsenate. Arsenious oxide and arsenious sulphide were more toxic to the larvae than was acid lead arsenate and were affected very slowly by the soil, but their detrimental effect on plants definitely limits their use in the soil. Paris green and certain of its homologues (copper oleo- lauro-, palmito- and stearoarsenite) could be substituted for acid lead arsenate to destroy the larvae, but their application is also limited by their toxicity to plants.

The inorganic borates of calcium, lead, magnesium, nickel, sodium, strontium and zinc were not sufficiently toxic to the larvae to be of value as stomach poisons. The inorganic fluorides of aluminium, barium, calcium, copper, lead, magnesium, strontium and zinc, and natural cryolite, were not toxic to the larvae. The fluosilicates of barium, magnesium, potassium and sodium were equivalent to, or even better than, acid lead arsenate when freshly applied, but their rapid decomposition in the soil to non-toxic compounds or loss of their insecticidal constituents by leaching makes them unsuitable as substitutes for it. Calcium fluosilicate was non-toxic when freshly applied. Derris, hellebore, pyrethrum and mowrah meal (the ground press-cake left after the removal of oil from seeds of *Bassia longifolia*, the active ingredient of which appears to be mowrin) were so slightly toxic to the larvae as to be of little practical value. Rotenone did not appear to be the ingredient in derris that was toxic to the larvae. The slight insecticidal action of derris was destroyed by adding lime to the soil.

Mell (C. W.). **Elimination of Lead Arsenate Residues used for insecticidal Purposes.**—*Flor. Rev.* **88** no. 2286 pp. 15–16, 2 figs. Chicago, Ill., 1941.

The application of acid lead arsenate to the soil of nursery beds at the rate of 1,500 lb. per acre to a depth of 3 ins. gives effective control of larvae of *Popillia japonica*, Newm., and has been widely practised in New Jersey as it allows the plants to be certified for shipment out of the quarantine district, but in some cases, when the soil is later used for other crops, the arsenical may injure the plants or be absorbed in sufficient quantities to make them poisonous as food. Investigations were, therefore, carried out in 1936–37 on the nature of the toxicity to plants of lead arsenate in soil of several different types and textures and on methods of leaching out the poison, which did not give promising results, and of converting the toxic substances to non-injurious ones. In greenhouse tests it was found that ferric and ferrous arsenates were absorbed less than other

arsenates and were practically non-toxic. Field tests with various types of bog iron ores and iron hydrate indicated that fixation of the arsenic by reaction with hydrated ferric or ferrous oxide took place in the field, and plots treated with these substances yielded distinctly larger crops than untreated ones. The results were not sufficiently definite, however, to indicate how much of the iron compound should be applied to counteract a given amount of lead arsenate in the soil. It is pointed out that failure of crops grown in arsenate-treated soil is partly due to removal of the top soil with the plants for shipment and partly to changes in the chemical and physical properties of the soil caused by heavy applications of arsenic, which cannot be corrected by fixing it, and that further work is necessary before definite recommendations can be made.

Reid jr. (W. J.), Smith (C. E.), Reed (L. B.) & Thomas (W. A.). **Field Studies of Insecticides used to control Cabbage Caterpillars in the South.**—*Tech. Bull. U.S. Dep. Agric.* no. 782, 35 pp., 7 figs., 5 refs. Washington, D.C., 1941.

Reid jr. (W. J.), Smith (C. E.), Reed (L. B.) & Bare (C. O.). **Studies on the Control of Cabbage Caterpillars with Derris in the South.**—*Circ. U.S. Dep. Agric.* no. 615, 26 pp., 9 figs., 11 refs. Washington, D.C., 1942.

The first of these papers comprises a detailed account of experiments carried out in South Carolina and Louisiana in 1933–35 to determine the comparative effectiveness of certain arsenicals and organic and inorganic substitutes for them against the larvae of *Plusia* (*Autographa*) *brassicae*, Ril., *Plutella maculipennis*, Curt., *Pieris rapae*, L., and several species of Agrotinae, chiefly *Agrotis ypsilon*, Hfn., *Feltia annexa*, Treitschke, and *Heliothis armigera*, Hb., on cabbage; practically all comparisons were made between materials applied as dusts. Some of the work has already been noticed from a briefer account [*cf. R.A.E.*, A **27** 370]; the derris dusts gave the most uniform results of the materials tested [*cf.* **28** 650], being among the most effective against each species except the Agrotines, to which calcium arsenate, Paris green and cryolite were the most toxic. It is concluded that a derris dust mixture containing 0·5–1 per cent. rotenone is sufficiently toxic to all the species but the Agrotines to be of value as a substitute for arsenicals in practical field control, and that pyrethrum diluted to contain 0·1 per cent. pyrethrin I is of value against *Pieris rapae* and *Plusia brassicae*.

In the second paper, investigations carried out in these States in 1935–37 on the number and schedule of applications of dusts of powdered derris root and china clay (0·5 per cent. rotenone) necessary to protect cabbage from damage by larvae of *Plusia brassicae*, *Plutella maculipennis* and *Pieris rapae* and the economic value of such treatments are described. It was found that protection of the autumn crop during the prolonged harvesting period was desirable; three applications of derris dust made between the time when the first heads began to form and the beginning of harvest, or three of Paris green and hydrated lime (1 : 9 by weight) before the formation of the first heads, followed by two of derris dust during the heading period, were the most valuable treatments and resulted in a considerable increase in marketable cabbage at the beginning of harvest. It was not usually profitable to apply the derris dust to spring cabbage earlier than just before the beginning of harvest, and one or more applications made after this time always resulted in a significant decrease in the number of damaged plants and an increase in the yield of marketable plants.

Jewett (H. H.). **Resistance of Strains of Red Clover to Pea-aphid Injury.**—*Bull. Ky agric. Exp. Sta.* no. 412, pp. 42–55, 2 figs., 5 refs. Lexington, Ky., 1941.

The following is based largely on the author's summary and conclusions. In tests in the insectary and in the field in Kentucky during 1936–40, the

injury caused by *Macrosiphum onobrychis*, Boy. (*Illinoia pisi*, Kalt.) to various strains of red clover was examined in order to discover, if possible, a strain definitely resistant to injury by this Aphid. Differences in the numbers of Aphids collected from several strains of red clover in 1936 and 1937 failed to show a definite preference for any one strain, though the numbers taken from individual plants varied considerably, indicating that there may have been some preference for plants within strains. Most of the strains compared for relative resistance were obtained from States in which *M. onobrychis* occurs, and since they were fairly well adapted to these regions, most of them were probably somewhat resistant to Aphid injury, accounting for the relatively small difference in resistance shown in the tests. The Kentucky and Tennessee clovers appeared to be slightly more resistant than the other strains. It is likely that highly resistant plants may be found among the clovers used.

Hanson (A. J.) & Webster (R. L.). **Insects of the Blackberry, Raspberry, Strawberry, Currant, and Gooseberry.**—*Pop. Bull. Wash. agric. Exp. Sta.* no. 164, 40 pp., 27 figs. (1 col.), 7 refs. Pullman, Wash., 1941.

This revision of a bulletin already noticed [*cf. R.A.E.*, A **27** 178] comprises brief notes on the bionomics and control of 27 species of insects and three mites that attack blackberry, raspberry, strawberry or currant and gooseberry in the Puget Sound region of Washington. The list of minor pests [*loc. cit.*] is omitted.

Doucette (C. F.). **Control of Insects and Mites attacking Narcissus Bulbs.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1890, 25 pp., 22 figs. Washington, D.C., 1941.

The author gives brief notes on the bionomics of the bulb flies, *Merodon equestris*, F., *Eumerus tuberculatus*, Rond., *E. strigatus*, Fall., and *E. narcissi*, Smith, and the mites, *Rhizoglyphus hyacinthi*, Banks, and *Tarsonemus laticeps*, Halbert, which are the principal Arthropod pests of narcissus in the United States, and describes the damage they cause and methods of controlling them. All the bulb flies overwinter as mature larvae in the bulbs ; *M. equestris* has one generation a year, and the species of *Eumerus* two and a partial third. *R. hyacinthi* attacks only damaged bulbs, but heavy infestations of *T. laticeps* are very injurious, causing distortion, stunting and failure of blooms.

No satisfactory method of controlling bulb flies in the field has been found in the United States, but small numbers of valuable plants may be protected by covering the rows with temporary cages having cheese-cloth sides and tops of wire screen (12 mesh) during the period of fly activity. Methods of treating the bulbs during storage are described in some detail. The bulb-fly larvae are killed by fumigation with hydrocyanic acid gas in a gas-tight chamber for four hours ; the gas is generated from granular calcium cyanide, spread on the floor at the rate of 16 oz. per 100 cu. ft., or from sodium cyanide, used at the rate of 7 oz. per 100 cu. ft. in a solution of 10½ fl. oz. concentrated sulphuric acid in 21 fl. oz. water. Vapour heat treatments [*cf. R.A.E.*, A **28** 82] and hot water treatments, in which the bulbs are immersed in water at 111°F. for 90 minutes, give complete control of the larvae of the bulb flies and of all stages of the mites.

Gahan (A. B.). **A new Chalcidoid Parasite of the Vetch Bruchid.**—*Proc. ent. Soc. Wash.* **44** no. 1 pp. 8–10. Washington, D.C., 1942.

A European Eulophid of the genus *Tetrastichus* was introduced into North Carolina in 1939 for the control of *Bruchus brachialis*, Fhs., on vetch [*cf. R.A.E.*, A **28** 577 ; **29** 48] and subsequently reared from host material collected in the release area. It is here described as *T. bruchivorus*, sp. n., from females

reared from *B. brachialis* and *B. ulicis*, Muls. & Rey, and a single male from *B. ulicis* in Var, France, females taken in quarantine at Philadelphia in seeds of vetch from Italy infested with *B. ulicis*, and 2 females reared from *B. brachialis* collected in North Carolina.

DEMAREE (J. B.) & RUNNER (G. A.). **Control of Grape Diseases and Insects in eastern United States.**—*Fmrs' Bull. U. S. Dep. Agric.* no. 1893, 28 pp., 21 figs. Washington, D.C., 1942.

This bulletin on the control of the principal fungous diseases and insect pests of grape-vines in the eastern United States supersedes a previous one [*R.A.E.*, A **10** 239] so far as the region east of the Rocky Mountains is concerned. The insects in question are *Polychrosis viteana*, Clem., *Erythroneura comes*, Say, *Fidia viticida*, Walsh, *Macrodactylus subspinosus*, F., *Desmia funeralis*, Hb., *Alypia octomaculata*, F., *Pholus achemon*, Dru., and *Aphis illinoisensis*, Shimer. Brief notes are given on their bionomics, suitable sprays are discussed, and a general programme for spraying grapes is included.

COTTON (R. T.), WAGNER (G. B.) & WINBURN (T. F.). **Insecticidal Value of certain Dusts for the Protection of stored Grain.**—*J. Kans. ent. Soc.* **15** no. 1 pp. 1–6, 3 refs. Manhattan, Kans., 1942.

In tests of dusts mixed with grain to protect it from insect attack, adults of the rice weevil [*Calandra oryzae*, L.], lesser grain borer [*Rhizopertha dominica*, F.] and cadelle [*Tenebroides mauritanicus*, L.] and adults and eggs of the flour beetle [*Tribolium*] were introduced into jars containing wheat with a moisture content of 16 per cent. that had been treated with a German product [Naaki] consisting of finely pulverised pure quartz sand [*R.A.E.*, A **24** 341 ; **27** 582] at the rate of 1 per cent. by weight. After 84 days at room temperature and humidity, large numbers of all four species were present in the wheat, though not so many as in untreated control wheat. The treatment appeared to have no deleterious effect on flour milled from grain cleaned by the ordinary process used in flour mills. Similar results were obtained when the insects were introduced into wheat treated with 1·66 or 3·33 per cent. by weight of an activated pyrophyllite (pyrophyllite with an extremely thin coating of aluminium fluoride and capable of passing through a 325-mesh sieve) stated to contain 75·4 per cent. silica, 20·4 per cent. aluminium oxide, small quantities of other oxides and 3·5 per cent. water.

To determine whether the efficacy of such dusts depends on the moisture content of the grain, further tests were made with a number of common dusts that are recommended against pests of stored grain. Samples of wheat with moisture contents of 10, 12, and 16 per cent. were treated with each of the dusts at the rate of 1 and in most cases 2 per cent. by weight and infested with adults of *C. oryzae* and *Tribolium* ; samples in which the moisture content was 10 per cent. were examined after 87, and the others after 112, days. Wood ashes and soy-bean flour had no appreciable effect on the development of the insects, but sulphur was slightly effective and lime gave good protection, when the moisture content was 10 or 12 per cent. ; lime gave some protection when the moisture content was 16 per cent., though this was not sufficient for practical purposes. Infestation did not increase, and there were no living insects in samples with moisture contents of 10 or 12 per cent. that were treated with borax at 1 per cent., but this treatment is not recommended since the borax is absorbed by the wheat. In untreated wheat, development was exceedingly slow when the moisture content was 10 or 12 per cent., but rapid when it was 16 per cent.

KLOSTERMEYER (E. C.). **The Life History and Habits of the Ring-legged Earwig,** *Euborellia annulipes* **(Lucas) (Order Dermaptera).**—*J. Kans. ent. Soc.* **15** no. 1 pp. 13–18, 8 refs. Manhattan, Kans., 1942.

Anisolabis (*Euborellia*) *annulipes*, Lucas, is almost cosmopolitan in distribution and omnivorous in feeding habits; it has diversely been observed as a pest in stored products and, in tropical countries, as predacious on noxious insects [*R.A.E.*, A **22** 451; **23** 44], including *Perkinsiella saccharicida*, Kirk., on sugar-cane in Hawaii. It occurs over a large part of the United States, but had not been recorded in Nebraska until 1939, when it was found feeding on stored grain and grain insects in a basement. Studies of its bionomics were made there during 1939 and 1940. All stages are described, and an account is given of the rearing technique adopted; the temperature at which rearing took place varied from 65 to 85°F.

Females that were fertilized only once produced as many as six batches of eggs; the pre-oviposition period averaged 10·77 days. The numbers of eggs deposited by individual females varied from 22 to 74. In nature, the eggs are deposited over a period of 2–3 days in shallow excavations in the soil under stones, etc., and the female remains with them during the incubation period. Of 25 newly-deposited eggs that were placed in a cell from which the female was excluded, five hatched after 17 days, and the rest were destroyed by mould; all of a batch of 27 that were left with the female hatched in 17 days, so that the association of the female with the eggs appears to be beneficial. Eggs in a dry atmosphere showed signs of severe desiccation in three days and failed to hatch. The incubation period was 9–19 days, and the five nymphal instars were completed in from 45 to 176 days. The nymphs fed readily on wheat and other grain, and required a high degree of humidity for development. Three successive generations were reared between March 1939 and May 1940. The adults lived for several months; some females were alive after more than 200 days.

SMITH (R. C.). *Nomophila noctuella* **as a Grass and Alfalfa Pest in Kansas (Lepidoptera. Pyralididae).**—*J. Kans. ent. Soc.* **15** no. 1 pp. 25–34, 4 figs., 14 refs. Manhattan, Kans., 1942.

A summary is given of observations carried out since 1920 on the biology of *Nomophila noctuella*, Schiff., in Kansas, where the larvae feed on lucerne and grasses, but have caused no noticeable damage to lucerne. The distribution and bionomics of this Pyralid are reviewed from the literature, all its stages are described, characters distinguishing the larvae from those of *Crambus vulgivagellus*, Clem., *Stenoma mistrella*, Busck, and *Acrolophus* sp., with which they are often associated and confused, are given in a table prepared by H. D. O. Miller, and differences between the cocoons are noted.

In Kansas, the adults were observed continuously from April to October, inclusive, and there appeared to be two generations a year. The eggs were attached to the substratum; the maximum number laid by a single female was 142. The newly-hatched larvae fed on the epidermis of one surface of the leaves, which they later skeletonised, and constructed small horizontal silken shelter-tubes in which particles of soil, etc., were incorporated, about the base of the plants. The larvae left these tubes only when disturbed or when conditions were unfavourable, and were observed to cut off leaves from the plant and drag them to the shelter tubes, where they fed on them. Pupation took place in silken cocoons with an outer layer of particles of soil and leaves formed on a level with the surface of the ground. The duration of the egg, larval, prepupal and pupal stages averaged 3, 17, 1 and 9 days, respectively, in May–June; the second generation overwintered in the larval stage. Oviposition began two or three days after emergence, and adults fed on dilute sugar solution survived for as long as two weeks.

The larvae were present on several occasions when grasslands were damaged during April, May and June, but they did not appear to be entirely responsible for serious injury. Four outbreaks that occurred in Kansas in April 1932 and April, May and June 1938 in which larvae that had overwintered in the sod destroyed or severely damaged grassland are described.; Crambine larvae were also present on two occasions. June grass (? *Koeleria cristata*), blue grass [*Poa*] and wild oat pasture and cultivated oats were all damaged, the larvae feeding on the roots of June grass when the foliage had been destroyed, but buffalo grass in the pastures was not attacked. An attempt to control the larvae by burning was unsuccessful, but at one place many larvae were destroyed by gulls after the field was harrowed. In the laboratory, larvae fed on brome grass [*Bromus*], but failed to develop, whereas others fed on lucerne completed their development; there was no feeding on Kentucky blue grass [*Poa pratensis*].

HARDY (D. E.). **A Note on Leafhopper Abundance.**—*J. Kans. ent. Soc.* **15** no. 1 p. 34. Manhattan, Kans., 1942.

Amblycephalus (*Cicadella*) *confluens*, Uhl., occurred in such numbers in a town in the Yakima Valley, Washington, in October–November 1941 as to be a considerable nuisance to the inhabitants, and similar outbreaks apparently take place each autumn. This Jassid is stated by P. W. Oman to feed exclusively on willow, and willow trees lining a stream that runs through the town are thought to be the source of the infestation. There are few trees in the district except in the town, and the swarms of the Jassids were evidently seeking winter quarters.

Zoology—Entomology.—*Rep. Ala. agric. Exp. Sta.* **50** pp. 39–43. Auburn, Ala. [1940]; *Op. cit.* **51** pp. 42–45 [1941]. [Recd. 1942.]

These reports include summaries of work carried out against insect pests of crops in Alabama in 1939 and 1940, respectively. In both, F. S. Arant gives the results of tests of insecticides against vegetable insects. In laboratory tests in 1939, derris, cubé, timbo and *Tephrosia* [*virginiana*], mixed with talc or sulphur to give 0·5 per cent. rotenone, were very effective against *Leptinotarsa decemlineata*, Say, in the laboratory; cubé gave 10 per cent. lower kill than the other dusts, and gave only 70–90 per cent. kill of *Epilachna varivestis*, Muls., in 72 hours, as compared with 100 per cent. for the other dusts. Sodium fluoride gave a more rapid kill of half-grown larvae of *Anticarsia gemmatalis*, Hb., than cryolite; lead and calcium arsenates were less effective than cryolite, and derris, timbo or cubé were practically useless; the median lethal doses of commercial lead arsenate and sodium fluosilicate were 0·13 and 0·21 mg. per gm., respectively. When insecticides were given to last-instar larvae of *Ceratomia catalpae*, Boisd., in leaf-sandwiches, the median lethal doses of *Tephrosia*, derris, timbo and cubé, all containing approximately 1 per cent. rotenone, were 0·066, 0·068, 0·112 and 0·168 mg. per gm., respectively; all were more toxic to small larvae than to larger larvae in the same instar. Dusts of derris and talc were effective against small nymphs of *Nezara viridula*, L., but not against large nymphs and adults, and more effective than dusts of derris alone or with sulphur against *Murgantia histrionica*, Hahn, on account of the adhesiveness of the talc. Dusts of derris, timbo or *Tephrosia* and talc (0·2 per cent. rotenone) gave 100 per cent. mortality of *Murgantia* in 48 hours, whereas cubé and talc gave only 88·6 per cent. Pyrethrum and nicotine dust (1 per cent.) were more rapid in their action but no more effective at the end of 30 hours than dusts of derris or cubé and talc (0·5 per cent. rotenone) against the turnip aphis, *Rhopalosiphum pseudobrassicae*, Davis; timbo appeared to

be less effective. Rotenone insecticides were not very effective against the Arctiid, *Apantesis phyllira*, Dru. ; acid lead arsenate, sodium fluosilicate and calcium arsenate were effective in the order given.

In field experiments in 1940, dusts of derris and talc containing 1 per cent. rotenone and about 10 per cent. flour gave approximately 96 per cent. control of *M. histrionica* on cabbage ; and a dust containing derris, sulphur, hydrated lime and nicotine sulphate (25 : 37·5 : 37·5 : 5 by weight) was much more effective against *Brevicoryne brassicae*, L., than one of derris and talc with the same rotenone content, but little or no more effective than one of derris, talc and nicotine sulphate (25 : 75 : 5). In the laboratory, the first mixture, diluted to contain 0·2 per cent. rotenone and 0·4 per cent. nicotine was less effective 20–26 days after mixing than derris and talc against adults of *L. decemlineata* and *M. histrionica*.

In the 51st report, L. L. English records tests on the fumigation of *Camellia* and azalea with methyl bromide. At a constant temperature of 80°F., the margin of safety between complete kill of the Coccids, *Lepidosaphes camelliae*, Hoke, and *Fiorinia theae*, Green, and plant injury decreased as the dosage was increased, and was too small for practical use at 4 and 6 lb. per 1,000 cu. ft. With a dosage of 2 lb. per 1,000 cu. ft., the margin of safety for *Camellia* was 1 hour at 80, 85 and 90°F., and ½ hour at 75 and 95°, and that for one variety of azalea was 1 hour at 80°F., ½ hour at 75, 85 and 90°F., and zero at 95°. At 80°F., there was negligible loss in cuttings of 34 out of 58 varieties of azalea and 24 out 46 varieties of *Camellia* after fumigation with 2 lb. methyl bromide per 1,000 cu. ft. for 1½ and 2 hours, respectively, and plants 8–20 inches high of 53 varieties of *Camellia* were practically uninjured at dosages of 2 lb. for 2 hours, 1 lb. for 3 hours and ½ lb. for 5 hours. Treatment with a dosage of 2 lb. methyl bromide per 1,000 cu. ft. for 2 hours at 80°F. is therefore recommended for practical work.

ANDISON (H.). **The Occurrence of the Clay-coloured Weevil** (*Brachyrhinus singularis* (**L.**)) **in British Columbia** (**Coleoptera**).—*Proc. ent. Soc. B. C.* no. 38 pp. 8–10, 5 refs. Vernon, B.C., 1942.

Weevils causing severe injury to the foliage of Portugal laurel [*Prunus lusitanica*] at Victoria in April 1937 were identified as *Otiorrhynchus* (*Brachyrrhinus*) *singularis*, L., which is not known to have been recorded before as an insect of economic importance in British Columbia. Brief notes are given on the early history, food-plants and distribution of the weevil in North America, where it has been found in Massachusetts and several Provinces in Canada, but seems to be scarce or local in occurrence. It is, however, sometimes an important pest of apple and small fruits in England [*cf. R.A.E.*, A **19** 637, etc.], and caused damage to blackberry, holly and roses and other flowering plants at Victoria during 1937–40. The larvae destroy the roots of the plants, and the adults feed on both old and new leaves and old leaf stems, sometimes defoliating the plants completely, and also on the bark of young growth, girdling the stems. The adults emerge from the soil during the latter part of March and begin to feed immediately ; the eggs are laid in the soil in late spring and summer and the larvae overwinter when half- to full-grown and pupate in March. Some adults pass through a second winter before completing oviposition. Light soils are particularly favourable to the development of the weevil, but it has frequently been recorded as attacking plants grown on clay land. Largely owing to the fact that it is parthenogenetic, it increases with great rapidity. Measures for its control are discussed [*loc. cit.*] and include thorough cultivation of the soil in March to disturb the pupae and newly formed adults. In laboratory experiments in 1938, an apple pomace bait containing 5 per cent. sodium fluosilicate was very effective against the adults.

WARD (I. J.). **A Note on the Use of Mechanical Bait Spreaders for Grasshopper Control in British Columbia.**—*Proc. ent. Soc. B. C.* no. 38 pp. 14–18, 2 figs. Vernon, B.C., 1942.

The author describes the basic features of the construction of the mechanical bait spreaders used for the control of grasshoppers in the Prairie Provinces of Canada [*cf. R.A.E.*, A **26** 590] and the adaptations found necessary for conditions in British Columbia, where the land is more rugged, so that it is undesirable for the speed of work of the spreader to depend on the speed of the vehicle carrying it. He points out that the use of such spreaders results in a saving of time, labour and material, quicker coverage and finer, more even distribution of the bait, giving more effective control with less risk to livestock, and makes it possible to apply baits extremely lightly to areas of low infestation and to standardise control in different areas.

HANDFORD (R. H.). **Progress Report on Grasshopper Bait Investigations, Canadian Prairies, 1941.**—[*Leafl.*] *Brandon Lab. Dep. Agric. Canada* no. 5, 16 pp. multigraph, 4 refs. [Ottawa, Ont., 1942.]

An account is given of experiments carried out in Manitoba with a view to developing an economical and effective bait that could be applied dry, reducing the cost of the wet flour-sawdust bait by decreasing the proportion of flour, and testing how long after application a bait is effective. Two methods were used. In the cage tests 100 grasshoppers were caged over lucerne or oats, the bait applied next morning and the final estimate of mortality made after five days. In plot tests, the plots were 0·2 acre in size ; the grasshoppers were allowed to feed for 1–3 hours ; three samples, of about one hundred grasshoppers each, were taken from each plot and confined in cages with green food for 72 hours, after which the mortality was counted. Conclusions were drawn on an analysis of the uncorrected data, since Abbott's formula [*R.A.E.*, A **13** 331] was found to accentuate the experimental error, particularly as the mortality in the controls became greater.

The following is based on the author's summary. Bran baits, prepared by spraying 100 lb. wheat bran with 1 quart liquid sodium arsenite solution (not less than 7·76 lb. pure As_2O_3 per gallon) and applied dry were as effective as baits applied while moist, and more effective than baits mixed with the normal quantity of water and then air-dried before application. Flour-sawdust baits were less effective when dry than in a moist condition. Sawdust alone was ineffective when sprayed with concentrated sodium-arsenite solution and applied dry. Wet flour-sawdust, 1 : 27, used against *Camnula pellucida*, Scud., was as effective as a 1 : 13 mixture, but the results were not reliable owing to high mortality caused by *Empusa grylli*. Baits exposed for five days before *Melanoplus mexicanus*, Sauss., was given access to them gave very poor results ; three-day old baits were somewhat better but still well below the freshly spread baits. A dry-prepared bran bait, and an oil bait (50 lb. wheat bran and an equal volume of sawdust, 1 qt. liquid sodium arsenite and 1 gal. lubricating oil) were no better in this respect than the wet bait. Baits spread in tall heavy stands of oats gave 52·5 per cent. average mortality, while similar baits spread in thinner and shorter stands gave 73·6 per cent.

SAUNDERS (L. G.). **The Raspberry Root-borer in Saskatchewan.**—*Canad. Ent.* **74** no. 1 p. 19. Guelph, Ont., 1942.

Adults bred from larvae found boring in the roots of raspberry in Saskatchewan in the spring of 1941 were identified as *Pennisetia* (*Bembecia*) *marginata*, Harr., which has not previously been recorded from this Province, but was probably introduced with stock from the east some years ago. Since

this Aegeriid spends the winter underground in the roots, it is not affected by the low temperature, and it is likely to spread and become established in the Province.

Brown (A. W. A.) & Daviault (L.). **A comparative Study of the Influence of Temperature on the Development of certain Sawflies after Hibernation in the Cocoon.**—*Sci. Agric.* **22** no. 5 pp. 298–306, 10 graphs, 9 refs. Ottawa, 1942.

Large numbers of overwintering cocoons of sawflies that damage forest and shade trees in Canada are reared there each year for experimental purposes, and in order to facilitate this work, a study was made in 1939–40 of the characteristic reactions of several species to the conditions of controlled temperature and humidity. The authors consider that the effect of temperature on the rate of development of a living insect can be adequately expressed on a graph by means of a straight line and that its thermal requirements can be described in day-degrees provided that only intermediate temperatures are taken into account. The essential temperature characteristics of the cocoon stage of the sawflies under consideration were therefore expressed by means of a thermal constant (or sum of effective temperatures) and a theoretical threshold of development. The developmental index for each temperature was derived as the reciprocal of the average time taken for emergence, and the developmental indices for each species are plotted on a graph against temperature as the ordinate. The linear relationship characterising these points on the graph was calculated by the method of least squares. At temperatures above 25°C. [77°F.] and those approaching the threshold there is a decrease in critical increments [*R.A.E.*, A **16** 642]. The deviation at the lower temperatures was ignored, since, for practical purposes, the threshold is useful only to determine the effective temperature in the developmental range, and the calculation of the thermal constant was limited to temperatures between the threshold and 25°C. The point at which the calculated index line crosses the ordinate is regarded as the theoretical threshold.

The species studied were *Neodiprion pinetum*, Norton, *N. swainei*, Middleton, *N. lecontei*, Fitch, *N. dubiosus*, Schedl, *Pikonema dimmocki*, Cress., *P. alaskensis*, Rohw., *Pristiphora geniculata*, Htg., and *P. erichsoni*, Htg., and about 10,000 cocoons were used during the investigation. After exposure to a temperature of 0°C. [32°F.] for three months, the cocoons were warmed at the rate of 1°C. [1·8°F.] per hour and on reaching successive points on the temperature gradient were placed in the appropriate chambers in a multiple temperature incubator, which is described. In 1939, no attempt was made to control humidity, which averaged 40–45 per cent., and the results were discarded, but in the following season the cocoons were placed in batches of up to 50 in small jars and the relative humidity was maintained at 90–95 per cent. by means of a saturated solution of potassium nitrate, the cocoons being suspended over the liquid on discs of copper screening. Under these conditions, more consistent results were obtained ; the thermal constant was lower, but in six of the eight species mortality was higher.

The results for each species in the second year and two in the first are summarised in graphs and tables. The value of the thermal constant was in most cases slightly higher for females than for males, but the values for the theoretical threshold were almost the same in both sexes. The species of *Neodiprion* are characterised by a high theoretical threshold and a comparatively low thermal constant, the highest thresholds and the lowest thermal constants being exhibited by *N. dubiosus* and *N. lecontei*, both of which occur most frequently on isolated trees under which the soil is rapidly heated in spring. *N. swainei*, which has a lower theoretical threshold than *N. dubiosus*, occurs more generally in the forest. The optimum temperature for survival

appeared to be about 22°C. [72°F.] for the species of *Neodiprion* and rather lower for the other two genera. *Pristiphora geniculata* and the two species of *Pikonema* are characterised by low theoretical thresholds and high thermal constants. The theoretical threshold of *P. dimmocki*, which is a northern species that occurs consistently in cool spruce forests, is below 1°C. [33·8°F.]

Observations were also made over a longer period on the emergence dates of sawflies from cocoons kept during winter and spring in screened cages under approximately natural conditions at ground level, and the dates on which 50 per cent. emergence occurred in each of the years 1936–40 are given in a table. It was found that species such as *Pristiphora geniculata*, which has a high thermal constant, are able to emerge before *N. lecontei*, which has a low one, because their threshold is low and they are therefore able to develop at temperatures at which the latter is still dormant. The effective air temperature for each day was calculated by taking thermograph records every two hours at a height of 4 ft. from the ground, subtracting the theoretical threshold of development from them, and dividing the sum of temperatures above the threshold by 12; the thermal constant was the sum of these effective temperatures from the beginning of the season until the date on which 50 per cent. emergence occurred. In general, the values were considerably lower than those obtained in the laboratory, and this is believed to be due to the discrepancy between the theoretical and the actual threshold, since some development may occur at temperatures below the calculated threshold; it may also be due in part to the stimulating effect of variable temperatures.

Pickles (A.). **Entomological Investigation.**—*Rep. Dep. Agric. Trin. Tob.* ***1940*** pp. 13–14. Trinidad, 1942.

Some of the information in this report on insect pests in Trinidad in 1940 has already been noticed [*R.A.E.*, A **29** 373, 648]. Outbreaks of the sugar-cane froghopper [*Tomaspis saccharina*, Dist.] were even more severe and widespread than in 1939 [*cf.* **29** 52], about 10,000 acres of canes being severely blighted. Pyrethrum dust gave satisfactory control on only one of four estates on which it was used. Young plant canes were seriously attacked by the Eumolpid, *Myochrous armatus*, Baly, early in the wet season, and large areas of cane were severely damaged by the larvae of *Laphygma frugiperda*, S. & A., and *Mocis* (*Remigia*) *repanda*, F.

The Coccids, *Lepidosaphes* spp. and *Prontaspis citri*, Comst., injured grapefruit trees in certain districts, but were successfully controlled with diesel oil, emulsified in the spray tank with common household soap and applied from a power sprayer. Oranges in some districts were severely attacked by larvae of *Cydia* (*Laspeyresia*) sp.

Annual Report of the Department of Agriculture (Jamaica) for the Year ended 31st March, 1941.—[2+] 24 pp. Kingston, 1941.

The report of the Government Entomologist, W. H. Edwards (pp. 9–10) includes a list of 37 insects that attracted attention in Jamaica in 1940–41, showing the plants, etc., that they attacked. In the report of the Conservator of Forests (pp. 15–17), C. Swabey states that the shoot borer, *Hypsipylla grandella*, Zell., was observed attacking cedar (*Cedrela odorata*) in plantations for the first time. In an appendix dealing with Agriculture in the Turks and Caicos Islands (pp. 23–24), H. T. Carrington states that possible export crops include cotton. Insects pests found on the islands, however, include *Platyedra gossypiella*, Saund., *Dysdercus* spp., and *Nezara viridula*, L., which must be controlled before cotton can be established as an economic crop; with the present facilities, it is doubtful whether a closed season could be supervised adequately, so that *P. gossypiella* and *Dysdercus* will probably prove troublesome.

DA COSTA LIMA (A.). **Sobre cupins brocas da goiabeira (Isoptera : Kalotermitidae).** [Termite Borers in Guava.]—*Bol. Soc. brasil. Agron.* **4** no. 4 pp. 377–387, 11 figs., 10 refs. Rio de Janeiro, 1941.

Most of the cases of injury by termites to living trees in tropical regions are attributable to species of the subgenus *Neotermes* of *Kalotermes*. The only record known to the author of such attack in Brazil is that of Bequaert [*R.A.E.*, A **14** 84], from whose paper he quotes, but in 1941 three guava trees in Rio de Janeiro were found to have been tunnelled by termites, though their general condition was unaffected. The termites in the three trees were identified as *K.* (*N.*) *wagneri*, Desneux, *K.* (*N.*) *fulvescens*, Silv., and a species close to the latter, respectively. The morphology and taxonomic affinities of some of the South American species of *Neotermes* are discussed.

PEMBERTON (C. E.). **Entomology.**—*Rep. Comm. Exp. Sta. Hawaii. Sug. Pl. Ass. 1940–41* pp. 21–27. Honolulu, 1941.

Most of the pests of sugar-cane in the Hawaiian Islands caused relatively little injury during the year ending 30th September 1941. *Anomala orientalis*, Waterh., was comparatively rare in all sugar-cane lands known to be infested on Oahu and did not spread in cane plantations. It was found, however, in pineapple fields about half a mile from cane areas ; it thrives in these fields and does considerable damage, particularly to ratoon pineapple crops. During August, its parasite, *Tiphia segregata*, Crwf., was found attacking *Adoretus sinicus*, Burm., in a region on Oahu not known to be infested with *Anomala*. Injury by *Rhabdocnemis obscura*, Boisd., was unimportant [*cf. R.A.E.*, A **30** 205] and is decreasing, owing to the substitution of hard for susceptible canes, and the effect of parasite activity and rat control [*cf.* **28** 460]. In spite of the scarcity of host larvae, the Tachinid, *Ceromasia* (*Microceromasia*) *sphenophori*, Villen., survived and contributed to the reduction of the weevil.

Damage by *Laphygma exempta*, Wlk., was light until July and August, when extensive infestations appeared on the island of Hawaii, and areas of 100 acres or more of young canes were defoliated. The egg parasite, *Telenomus nawai*, Ashm., was distributed on Kauai and appeared to give satisfactory control of incipient outbreaks of this armyworm. All the parasites known to attack *L. exempta* in the Islands were found on Hawaii, but the Tachinids, particularly, *Achaetoneura* (*Frontina*) *archippivora*, Will., and *Chaetogaedia monticola*, Big., were rather scarce on most plantations. Parasites appeared to be most numerous where least chemical weed control was carried out, and it is known that the Tachinids are killed by feeding on weed sprays. Sugar-cane pests that were successfully controlled throughout the year by parasites included *Perkinsiella saccharicida*, Kirk., *Oxya chinensis*, Thnb., *Nacoleia* (*Omiodes*) *accepta*, Btlr., *Aphis sacchari*, Zhnt., *Pseudococcus boninsis*, Kuw., *Trionymus sacchari*, Ckll., and *Gryllotalpa africana*, P. de B.

Ampulex compressa, F., which parasitises cockroaches, was introduced in November from New Caledonia and is now established on Oahu. Certain insects attacking vegetable crops that may be important in case of a food emergency in Hawaii were studied. It was found that Kryocide [a natural cryolite dust] gave effective control of *Euscepes postfasciatus*, Fairm., and *Omphisa anastomosalis*, Gn., on sweet potato, and of *Maruca testulalis*, Geyer, on lima beans. *Angitia* (*Dioctes*) *chilonis*, Cushm., introduced from the Orient in 1928 for the control of *Chilo simplex*, Btlr., on rice, was found to be parasitising 10–50 per cent. of the larvae of *O. anastomosalis* in two districts. It is reported that coconut trees on Kauai that appeared to be dying owing to mass infestation by *Pinnaspis buxi*, Bch., in 1936, when *Telsimia nitida*, Chapin [*cf.* **29** 331] was liberated on them, have completely recovered.

During the year, few insects reached Hawaii alive in trans-Pacific aircraft [*cf.* **30** 205], and it is unlikely that any of them escaped after reaching Pearl Harbour. Though most of the insects found on the aircraft are unimportant, a few are dangerous pests ; living adults of *Anomala sulcatula*, Burm., reached and were destroyed at Midway Island in aeroplanes from Guam, and *Prodenia litura*, F., which is established on Canton and Midway Islands, but does not occur in Hawaii, sometimes flies into the aeroplanes at night. *Telenomus nawai*, which develops in the eggs of *P. litura*, is being introduced into Canton Island, where this moth is prevalent [*cf.* **30** 99].

Lever (R. J. A. W.). **Entomological Notes.**—*Agric. J. Fiji* **12** no. 4 pp. 117–120, 23 refs. Suva, 1941.

Adults of the fruit-piercing moth, *Othreis fullonia*, Cl. (*fullonica*, L.), were recently reported to have damaged grapefruits on the eastern coast of Viti Levu ; ripe guavas, mangos and bananas are also attacked in Fiji. The larvae do not feed on *Citrus* [*cf. R.A.E.*, A **29** 389], but on *Erythrina indica*. Mangos on the northern side of Viti Levu are attacked by the adults of *O. materna*, L., which is less common than *O. fullonia*.

Lists are given of the more important injurious insects that occur in Hawaii, New Caledonia, New Zealand and New South Wales, but not in Fiji, and that might be introduced by means of an air service linking these places.

Records of the occurrence of the weevils, *Diocalandra taitensis*, Guér, and *D. frumenti*, F., on coconut in various islands in the Pacific are given, and divergent opinions as to the extent of the damage they cause are discussed. *D. frumenti* has not been observed in Fiji, and *D. taitensis* was found to be rather scarce on palms in Viti Levu and Rabe in August and October, respectively, when it caused practically no primary injury. An apparently undescribed species of *Diocalandra* was recently reported damaging the flowers and young nuts in the British Solomon Islands.

Sloan (W. J. S.). **The Control of Tomato Pests.**—*Qd agric. J.* **56** pt. 4 pp. 277–294, 4 pls. Brisbane, 1941.

Notes are given on the bionomics and control of various pests of tomatos in Queensland, together with a key to them based on the injury caused. They are arranged under the parts attacked. The pests of the roots comprise a Nematode, and the adults of *Trissodon* (*Isodon*) *puncticollis*, Macl., outbreaks of, which are sporadic but severe. Cutworms, particularly *Euxoa radians*, Gn., and the larvae and adults of *Dasus macleayi*, Blkb., attack the stems of seedlings at ground level. Adults and nymphs of the Acridids, *Valanga irregularis*, Wlk., and *Peakesia straminea*, Sjöst., feed on the foliage and stems of young tomato plants in seed beds and in fields, particularly during dry weather. The mite, *Phyllocoptes lycopersici*, Massee, causes curling, discoloration and death of the leaves of plants of all ages, while the lower part of the stem loses its surface hairs, becomes darkly coloured and sometimes develops cracks. *Empoasca terrae-reginae*, Paoli, attacks the older leaves, which curl and die prematurely, and occasionally disfigures the fruit. This Jassid is particularly important in northern Queensland, where the populations are highest in the late winter and early spring, when most crops have reached their peak picking period. *Macrosiphum solanifolii*, Ashm., feeds on leaves, blossoms and young growth, causing curling of the leaves, distortion or death of the shoots and blossom fall, and transmits virus diseases. Larvae of *Plusia argentifera*, Gn., cause occasional damage in seed beds by attacking the foliage.

Heliothis armigera, Hb., is the most serious pest of tomatos in Queensland ; the larvae attack the fruits and flowers and also cause occasional injury to the leaves and stems. Larvae of *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell., cause considerable damage to tomato fruits in north Queensland, particularly

in dry weather. Already injured fruits are infested by *Lonchaea aurea*, Macq., *Drosophila* sp. and Sarcophagids. When severe infestations of *Dacus* (*Strumeta*) *ferrugineus tryoni*, Frogg., *D.* (*S.*) *f. dorsalis*, Hend., and *D.* (*Austrodacus*) *cucumis*, French, occur on other crops, tomatos are also attacked, but these Trypetids are usually of little importance on tomato. The Pentatomids, *Nezara viridula*, L., *Cuspicona simplex*, Wlk., and *Plautia affinis*, Dall., feed on the fruits, causing them to become discoloured and misshapen ; the Lygaeid, *Nysius vinitor*, Bergr., causes similar injury to the fruit, and it also attacks other parts of the plant when infestation is heavy. Large populations of *Frankliniella* sp. are probably responsible for faulty setting of fruit in northern Queensland.

Insect Pests.—*Agric. Gaz. N.S.W.* **53** pt. 1 pp. 36–40, 6 figs. Sydney, 1942.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **30** 471] includes notes on *Aulacophora* (*Ceratia*) *hilaris*, Boisd., which occurs in most coastal and inland areas, but is usually injurious only in some districts in the north of the State, where it attacks early crops of cucurbits. Every few years, however, there is a general outbreak of this Galerucid, and pumpkins, melons, squashes and cucumbers in most districts are heavily infested by the adults, which also cause occasional local losses of cherries and figs. Cucurbits are attacked at all stages of growth, and young plants may be destroyed in a few hours. In older crops, a few individual plants may be badly damaged or destroyed, but those that have begun to form runners usually outgrow infestation. The eggs are laid singly or in groups, and in the laboratory are deposited freely on moist soil. The immature stages have been found only once in the field, in the roots and stems of pumpkin. Pupation takes place in the soil at a depth of 1–6 inches. Development lasts about six weeks in summer and about 10–12 weeks in spring or autumn. The adults live as long as a year ; oviposition may extend over several months and is sometimes continued in the spring by females that have survived the winter. The average number of eggs laid per female is about 500. Small plants can be protected by daily treatment with inert dusts, such as hydrated lime, equal parts of lime and tobacco dust, or flour. Larger individual plants can be dusted with derris or a mixture of pyrethrum powder and flour (1 : 4), both of which destroy many beetles and prevent reinfestation for a day or two.

The Coreid, *Mictis profana*, F., which is widely distributed in Australia, was abundant in New South Wales in 1941–42 and attacked fruit trees and cultivated garden plants, including *Citrus*, grape and rose. On *Citrus* it usually feeds on the young shoots, sometimes causing them to die back. Its preferred native food-plants appear to be species of wattle [*Acacia*], *Cassia* and *Eucalyptus*. It can be controlled by hand-picking if only a few plants are infested, or by a spray prepared by soaking overnight 1 lb. pyrethrum powder in 1 gal. kerosene, emulsifying the strained extract with a solution of ½ lb. soap in 1 gal. water, and diluting to 40 gals. for application.

The native weevil, *Perperus vermiculatus*, Lea, occasionally damages apple trees in the Penrose district. The adults appear when the buds begin to burst and attack buds and young foliage, sometimes causing considerable injury to young and reworked trees. The larvae attack the roots, pitting and scarring the bark. No alternative food-plant has been found. The routine sprays against the codling moth [*Cydia pomonella*, L.] are applied too late to protect the tree from this weevil, but in limited tests with a spray containing approximately 3½ lb. cryolite and 1 quart white-oil emulsion per 100 gals., feeding ceased soon after spraying and most of the weevils were dead in 24 hours.

The native Lygaeid, *Oxycarenus arctatus*, Wlk., does not normally attack cultivated plants, but it was unusually abundant in 1941–42, and infested various orchard fruits, particularly plums, apricots, peaches and figs, and cultivated garden plants, probably owing to the unusually dry season and consequent lack

of green herbage. The bugs cluster mainly on the fruits, round the stalks and under leaves that are in contact with the fruit. Eggs were laid in the field during the middle of November on marshmallow (*Malva* sp.), under the sepals enclosing the fruit, and on the leaves. Dusting infested plants with a mixture of equal parts of pyrethrum powder and 2½ per cent. nicotine dust gave good results. A dust of pyrethrum powder and talc (1 : 2) or the emulsion of kerosene and pyrethrum recommended against *M. profana* can also be used.

ATHERTON (D. O.). **The Sorghum Midge.**—*Qd agric. J.* **56** pt. 6 pp. 444–449, 2 pls. Brisbane, 1941.

There has been a rapid expansion of the area sown to grain sorghums in south-eastern and central Queensland during recent years, but yields have been considerably reduced in some areas by *Contarinia sorghicola*, Coq. [*cf. R.A.E.*, A **29** 466; **30** 385]. The chief injury is that to grain sorghums; other cultivated sorghums, including Sudan grass [*Sorghum sudanense*], and Johnson grass [*Sorghum halepense*], which grows as a weed, are also attacked in Queensland, but native grasses are not. Damage by this Cecidomyiid is confined to the young seeds developing in the head, and no other part of the plant is affected. In heavily infested plants one or more grains usually mature on otherwise sterile heads, injury being more severe in late maturing crops. In varieties in which the tillers mature some weeks later than the central head, the damage is principally to the tillers.

The egg, larval and pupal stages, all of which are passed in the spikelets, last about 2, 7–10 and 3 days in summer, and the life of the adults is very short. The female deposits about 100 eggs singly between the glumes of the flowers shortly after they open, and the larvae feed on the young seeds, preventing their development. At the approach of winter, the full-fed larvae spin flimsy cocoons and development ceases until the spring, when most of the overwintered larvae pupate and give rise to adults. A few diapause throughout the summer and following winter, giving rise to adults about 18 months after becoming full fed. Although the adults that emerge in spring are not numerous, the rapidity with which the summer generations develop enables a large population to be built up in a short time wherever food-plants are continuously available in the flowering stage. Birds, spiders, ants and parasitic Hymenoptera destroy considerable numbers of *C. sorghicola*, but do not afford effective control.

Recommendations for control comprise the destruction of all residues of grain and fodder sorghums by mid-September, the sowing of sweet sorghums after the grain sorghum crop has been planted, cutting Sudan grass for hay a week after flowering begins should there be any likelihood of its heading before the grain sorghum, and sowing only one reliable variety of grain sorghum in a single planting, so that it will mature at the end of the wet season.

ALLMAN (S. L.). **Observations on various Species of Fruit Flies.**—*J. Aust. Inst. agric. Sci.* **7** no. 4 pp. 155–156. Sydney, 1941.

Dacus (*Strumeta*) *ferrugineus tryoni*, Frogg., was unusually active in many parts of New South Wales in 1940–41 [*cf. R.A.E.*, A **30** 280], and bananas, normally quite free from infestation, were attacked early in the season. Many oviposition punctures were observed in green angular bananas, but the infestation was mainly evident on bunches containing cracked or damaged fruits. The eggs hatched, and though most of the young larvae failed to penetrate the thick skin, development proceeded normally in many fruits, 296 individuals being bred from one sample of 28 bananas. Passion fruits [*Passiflora edulis*] were also stung to a considerable extent [*cf. loc. cit.*] and developed characteristic woody growths about the sites of the oviposition punctures. In most cases no

further development took place, and, where larvae continued to develop, they were unable to leave the fruits and the resultant adults were similarly imprisoned. Tomatos and blackberries were fairly generally infested, and fruits of *Niemeyera prunifera*, *Eugenia jambos*, *E. luehmanni* and *Lonicera hildebrandiana* were also observed to be attacked. The adults were noticeably attracted to *Phaseolus caracalla*, but no breeding was possible as its flowers dropped.

D. (*S.*) *humeralis*, Bez., which was previously recorded as a pest of *Citrus* in northern Queensland, was found for the first time in New South Wales, where it was bred in two districts, from mulberries, plums and fruits of *N. prunifera* and *Bryonia laciniosa*. *D.* (*S.*) *halfordiae*, Tryon, which commonly infests native fruits but had not been recorded from cultivated ones, was bred from grapefruit on one occasion and in numbers from fruits of *Sideroxylon australe* and *N. prunifera*. *D.* (*S.*) *strigatus*, Perkins, and *D.* (*Melanodacus*) *niger*, Tryon, were taken in traps at St. Ives ; the host-fruits of the former are not known, but the latter has been bred from the fruit of a native tree, *Symplocos thwaitsei*, in Queensland. *Ceratitis capitata*, Wied., was bred from *Citrus* fruits in one district in New South Wales and reported from traps in two others ; it continues to be rare even in many districts where it was abundant many years ago. *Rioxa pornia*, Wlk., was bred from passion fruit ; it is normally considered to infest damaged or over-ripe fruit, and its development from such woody fruit is surprising. It was also bred from *Syderoxylon australe* and *N. prunifera*.

The possibility of injurious species of fruit-flies breeding in native fruits is of importance, and a number of tests were carried out, flies being fed on a mixture of sugar and peptone, after which various fruits were introduced into the cages. *D. f. tryoni* bred readily in the fruit of *S. australe*, and the common non-injurious species, *D. halfordiae*, in apples and peaches, although fruits that they normally infest were also available. This behaviour under laboratory conditions is not observed in the field. Under cage conditions, unusual egg deposition has been noted, eggs being laid freely on the glass tops or paper linings of cages when fruits were not present. Eggs were also laid on potatoes, carrots, turnips and broad beans, and hatched normally, but no further development took place except on beans, on which it was not completed.

Variations in bristle development observed in flies bred under cage conditions and in a few from the field are discussed. In some of the laboratory reared flies, the unusual features were symmetrically arranged and were of such a nature that the individuals concerned might be misidentified on the basis of the present schemes of classification.

De Fluiter (H. J.). **Over het voorkomen van de grijze Dadapschimmel op Koffie.** (On the Occurrence of the grey Dadap Fungus on Coffee.)—*Bergcultures* **15** no. 42 p. 1441, 1 fig. 1941. [Abstr. in *Rev. appl. Mycol.* **21** pt. 3 pp. 136–137. Kew, 1942.]

Septobasidium bogoriense is recorded as infesting *Ischnaspis longirostris*, Sign., and *Coccus viridis*, Green, on berries and branches of coffee in Java, almost completely investing them with a grey crust.

Martin (J. T.). **The Problem of the Evaluation of Rotenone-containing Plants VI. The Toxicity of *l*-Elliptone and of Poisons applied jointly, with further Observations on the Rotenone Equivalent Method of assessing the Toxicity of Derris Root.**—*Ann. appl. Biol.* **29** no. 1 pp. 69–81, 2 graphs, 16 refs. London, 1942.

The following is based largely on the author's summary. The assessment of toxicity by the rotenone-equivalent method, by which the full toxic effect of the root is determined by the summation of the toxicities of each fraction with

allowances for the extent to which they occur [*cf. R.A.E.*, A **29** 30], was shown to apply to four of the derris roots examined earlier in this series of investigations. Observations on the stability of the resins in ground roots stored in tins at room temperatures were recorded. *l*-Elliptone was shown to be one-fifth as toxic as rotenone to *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., when tested in an alcohol-saponin medium. The toxicities of poisons applied jointly were examined. When the observed toxicities of mixtures of rotenone with a deguelin concentrate, *l*-elliptone and *l*-α-toxicarol were compared with those predicted from the potencies of the constituent poisons, no significant synergistic or antagonistic effect was found, and it is therefore considered that the use of the rotenone-equivalent method for assessing the toxicities of derris roots or resins is justified.

FINNEY (D. J.). **The Analysis of Toxicity Tests on Mixtures of Poisons.**—*Ann. appl. Biol.* **29** no. 1 pp. 82–94, 1 graph, 10 refs. London, 1942.

The following is based on the author's summary. Mathematical formulae proposed by Bliss [*R.A.E.*, A **28** 199] for the description of possible modes of action of mixtures of poisons are discussed. His suggested representation of synergistic action [**28** 200] is considered to be inadequate and to have no logical relationship with the simpler concept of similar action, and an alternative is presented, but no data were found on which to test it.

Three toxicity tests, of mixtures of rotenone with deguelin concentrate, elliptone and *l*-α-toxicarol, respectively, against *Macrosiphum* (*Macrosiphoniella*) *sanborni*, Gill., were examined. In each case, a hypothesis of independent action of the constituents would underestimate the toxicity of the mixture, but similar action satisfactorily predicts the observed percentage kills. Statistical tests for the assessment of the significance of departures from the hypotheses were developed and applied. When similar action adequately describes the effects of poison mixtures, the potency of any such poison is the same as that of its rotenone equivalent, obtained by addition of the rotenone dosages equivalent to the amounts of the separate constituents present.

A third statistical method for the investigation of similar action was devised. By its use, data on the toxicity of ether extracts of various derris roots, which were used by Bliss as an example of synergistic action, were shown to be perfectly consistent with the simpler hypothesis of similar action between the rotenone and dehydro mixture contained in the extracts. A further series of results by Martin on extracts of four derris roots [*cf.* preceding abstract] were tested in the same way, and shown to be consistent with a hypothesis of similar action between the quantities of rotenone, toxicarol and deguelin concentrate estimated from chemical analyses. The comparison of these roots with rotenone alone does, however, suggest that some synergistic action may have occurred.

KASSANIS (B.). **Transmission of Potato Virus *Y* by *Aphis rhamni* (Boyer).**—*Ann. appl. Biol.* **29** no. 1 p. 95, 3 refs. London, 1942.

Although *Aphis rhamni*, Boy., is one of the commonest Aphids on potato, there is no record of its transmitting a potato virus in Britain. Since, however, potato virus Y [*Marmor cucumeris* var. *upsilon* of Holmes] has relations with its vectors similar to those of severe etch virus of tobacco [*M. erodens* var. *severum* of Holmes], which is readily transmitted by this species [*cf. R.A.E.*, A **30** 268], greenhouse experiments were carried out in which the transmission of the former virus between tobacco plants and between potato plants by *A. rhamni* and *Myzus persicae*, Sulz., was compared. *A. rhamni* was kept on either healthy potato or the winter food-plant, *Rhamnus cathartica*, and some of

the Aphids were starved for four hours before being transferred to infected plants, on which all were allowed to feed for 2–5 minutes. It was found that *A. rhamni* transmitted the virus to 22 of 25 and 7 of 20 healthy tobacco plants and to 7 and 3 of 10 healthy potato plants when starved and unstarved, respectively, and that *M. persicae* transmitted it to 15 and 7 of 15 tobacco plants and to 5 and none of 5 potato plants when starved and unstarved. It is therefore concluded that in the greenhouse, *A. rhamni* transmits potato virus Y as effectively as *M. persicae* and reacts to a preliminary starving period in the same way.

Reid (J. A.). **The Species of *Laemophloeus* (Coleoptera : Cucujidae) occurring in stored Foods in the British Isles.**—*Proc. R. ent. Soc. Lond.* (A) **17** pt. 1–3 pp. 27–33, 13 figs., 6 refs. London, 1942.

The author gives a key, based on external differences, to the species of *Laemophloeus* that are found in stored products, such as grain, cacao and spices, in the British Isles; these comprise *L. ferrugineus*, Steph., *L. minutus*, Ol., *L. turcicus*, Grouv., *L. janeti*, Grouv., and an undetermined species near *L. ater*, Ol. As the external differences between the first three species are very slight, characters distinguishing the genitalia and associated structures, which provide a sure means of separating them in either sex, are described.

Smee (C.). **Report of the Entomologist, 1941.**—14 pp. typescript. [Zomba, Dep. Agric.] Nyasaland, 1942.

There were in general no serious outbreaks of insect pests in the Nyasaland Protectorate in 1941, in spite of an exceptionally dry season. *Platyedra gossypiella*, Saund., was present on cotton in the Lower River districts in only small numbers, and this reduction may have been due to a well-conducted "close season" campaign [*cf. R.A.E.*, A **29** 588], which was also beneficial in one area against *Diparopsis castanea*, Hmps. The berry moth, *Thliptoceras octoguttale*, Feld., was found on a few bushes of coffee.

The outbreak of *Niphadolepis alianta*, Karsch, on tea appeared to be coming to an end [*cf. loc. cit.*], and this Limacodid was not numerous anywhere. Some of the larvae entered a prolonged diapause after spinning their cocoons, and mortality in the cocoons was high. Of 850 cocoons collected in May 1940, 135 had given rise to adults by the end of 1941, of which 76 per cent. emerged in December 1940 and January 1941. Emergence was then at a low rate, but one male emerged 611 days after the cocoons had been collected. The percentage parasitism of the diapausing larvae by *Chrysis* sp. was about 8. Most of the parasites emerged in May–August 1940. In general, larval parasitism throughout the outbreak was low, the only parasites reared from some 400 larvae under observation in the laboratory being one example of *Rhogas* sp. and 10 Eulophids, apparently representing 3 species of *Platyplectrus*. One of the latter was parasitised by *Pleurotropis* sp. Other pests of tea included *Pseudococcus perniciosus*, Newst. & Willc., which was less numerous than in 1940, and the red spider [*Paratetranychus bioculatus*, W.-M.], which was also less numerous than usual in spite of the drought.

Tung trees (*Aleurites fordi* and *A. montana*) have remained free from serious insect injury but are attacked by several Coccids [*cf.* **29** 62], which appear to have no detrimental effect on them. Of these, *Icerya purchasi*, Mask., and *Pulvinaria jacksoni*, Newst., are usually held in check by *Rodolia* (*Novius*) *obscura*, Weise. In one case, *Aspidiotus hederae*, Vall., damaged young *A. fordi* growing in poor soil with a heavy growth of tall grass and weeds. A bark-burrowing scale, identified as *Clavaspis herculeana*, Doane & Hadden,

was very generally distributed on both species of *Aleurites*. It spread upwards from the lower parts of the trunk and was accompanied in one district by *Howardia biclavis*, Comst. Neither of these Coccids caused any serious damage. In experiments against *C. herculeana*, almost complete mortality was obtained by brushing the main stems and lower branches with strong lime-sulphur (1 : 4) or a proprietary insecticide. *Pseudococcus perniciosus* occurred in one tree, and the area infested by *P. adonidum*, L. (*longispinus*, Targ.) considerably increased [*cf.* **29** 62]. Active migration took place in June, and previously uninfested trees were attacked. Young terminal shoots on some trees were killed, but this may have been due partly to poor soil and drought. There was a decrease in infestation at the end of the year. Spraying against this mealybug would be difficult and costly, and lime-sulphur wash on the trunks did not prevent the young from ascending. The clusters of mealybugs in the branch-forks and on the apex of the young shoots were attacked during the dormant season by various predators and by Chalcidoid parasites of at least eight genera, some of which, however, were undoubtedly hyperparasites.

A severe outbreak of *Chilo* sp. occurred on sorghums, particularly in the Lower River districts, and there was no parasitism by *Apanteles sesamiae*, Cam., which was active in a previous outbreak [**18** 424]. The adults emerged from the stalks up to early June, and continued to do so from the dry material in the laboratory throughout September. It is advised, therefore, that all plant refuse should be burnt in cases of serious attack. A white scale that frequently occurs at the base of the stems of pigeon pea [*Cajanus cajan*], especially on ratooned plants in their second year, has been found to be *Pinnaspis* (*Chionaspis*) *cyanogena*, Ckll., while the black Dynastid that has been recorded as damaging the roots of rice plants was identified as *Heteronychus mosambicus*, Pér. It occurs only in fields from which the water has receded and of which the surface remains merely damp, and is absent when the soil really dries out and during the main rains. It is not a serious pest in Nyasaland, but lands should not be selected for the cultivation of rice if they regularly afford the damp conditions that favour infestation. A white scale, apparently a species of *Chionaspis*, was abundant on the stems of cassava and was apparently preyed upon by the Coccinellid, *Chilocoris distigma*, Klug. Stored dried cassava roots were attacked by the larvae of an unidentified Bostrychid. *Cylas puncticollis*, Boh. (*compressus*, Hartm.), which is indigenous in Nyasaland, seriously damaged or completely destroyed several consignments of sweet potatoes despatched from Amani in 1939–40. The developing pods of soy bean were infested by the larvae of *Cydia* (*Laspeyresia*) *ptychora*, Meyr., while a small planting of cowpeas was seriously damaged by a species of *Agromyza* (*Melanagromyza*), previously recorded on beans (*Phaseolus*) [**29** 154] and soy beans. A severe outbreak of *Crocidolomia binotalis*, Zell., and *Plutella maculipennis*, Curt., occurred on cabbages, chiefly near Limbe and Blantyre, and most of the crop was destroyed before any effective measures could be taken. The former is usually kept in check, apparently by *Bassus laetatorius*, F., and *Disophrys* sp., but these parasites may have been affected by the drought.

Miscellaneous insects observed included *Trionymus* (*Pseudococcus*) *sacchari*, Ckll., on sugar-cane, the Limacodid, *Omocena convergens*, Hering, on tea and castor, and the parasites, *Euplectrus laphygmae*, Ferrière, reared from *Laphygma exigua*, Hb., and *L. exempta*, Wlk., *Euplectromorpha obscurata*, Ferrière, from *Tortrix* (*Cacoecia*) *occidentalis*, Wlsm., on cotton, *Euplectromorpha* sp. and *Platyplectrus* sp. from *Parasa vivida*, Wlk., on coffee, *Neoplectrus* sp. from the Limacodid, *Micraphe lateritia*, Karsch, on *Aleurites*, with the hyperparasite, *Pleurotropis neavei*, Wtstn., and *Encyrtus barbatus*, Timb., from *Coccus* (*Lecanium*) *hesperidum*, L., on tea.

Nomadacris septemfasciata, Serv., was the only locust observed in the Protectorate [*cf.* **29** 589] and was active only in the south. Hoppers hatched fairly extensively throughout January in the Lower River districts. In the

Shire Highlands, egg-laying occurred chiefly in the Mlanje district, and further north, it took place only in the lake shore area of the Dedza district. Bands of hoppers were present in all these areas from January to March, but whenever possible they were destroyed or greatly reduced by the usual control measures. Flying swarms developed by the second week of March in the Lower River districts and during March–April elsewhere. Some of them were large and had probably developed in the Zambezi valley ; they were particularly numerous in the vicinity of Mount Mlanje, where a few tea bushes and some shade trees in tea gardens were defoliated. The north-westerly movement occurred in May. In September, activity increased with rising temperatures, and some large swarms reached Zomba and the Chikala Hills, in the north-east. In November and December, activity was confined to the Lower River districts. Egg-laying occurred on a small scale in three districts, but no hatching was reported before the end of the year, when adult activity appeared to have ceased.

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